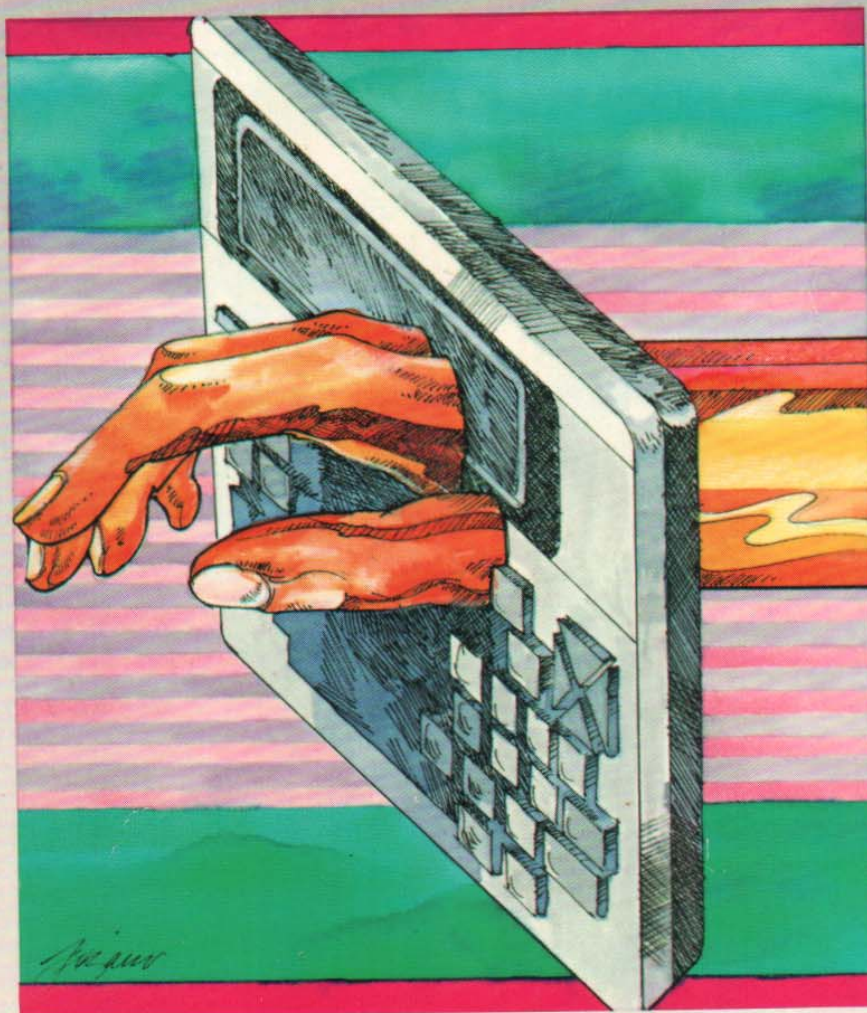


MARVIN C. MALLON

*Exploring the  
NEC PC 8201A*



CBS Computer Books

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# EXPLORING THE NEC PC-8201A

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Marvin C. Mallon

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**CBS Computer Books**

**HOLT, RINEHART AND WINSTON**

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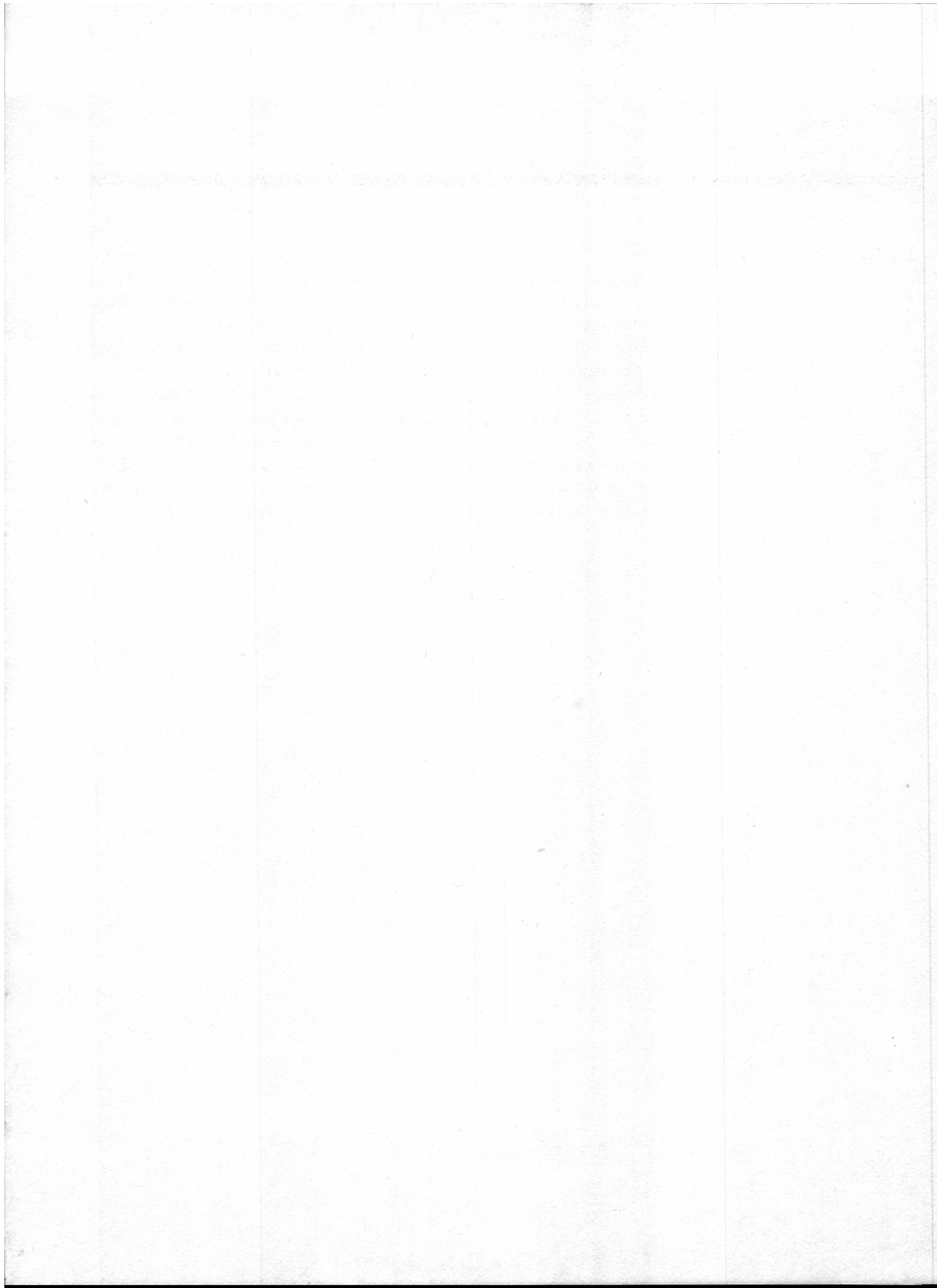
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## **Author Biography**

Marvin C. Mallon is a professional microcomputer programmer and business consultant. He has advised hundreds of first-time users in the selection of both equipment and software. He has authored many technical articles dealing with a variety of computer hardware dating back to 1976, the dawn of the Age of the Micros. Presently he is serving his third term as a member of the Board of Directors of the Los Angeles chapter of the I.C.C.A. (Independent Computer Consultants Association). In addition to participating in numerous seminars he has taught courses in BASIC programming to a broad cross-section of interested newcomers to the computer world. Mr. Mallon has more than seven years of experience in this very fast-paced industry and has contributed in a variety of ways to its growth.





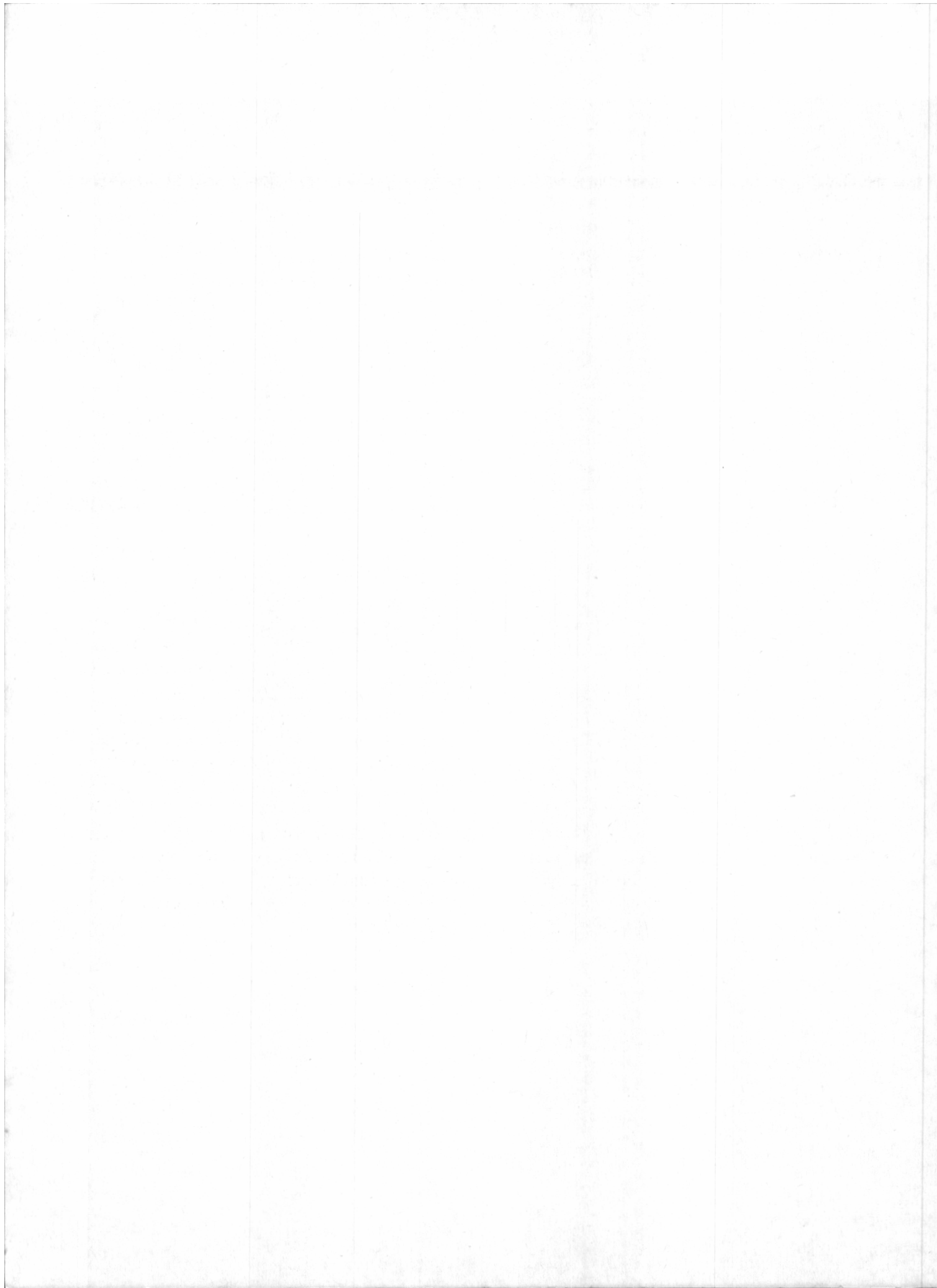
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## **Dedication**

To my daughter Susan,  
who has befriended numerous computers.





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## Acknowledgments

No technical book is ever the product of a single individual. The author, if he or she is thorough in their work, compiles information from many sources so as to improve the value of the book to the reader. Such was certainly the case here. I am indebted to many people for the assistance, both technical and spiritual, that helped produce this book.

At NEC-HE (USA) (Nippon Electronic Corporation Home Electronics), I received support from Mss. Linda Levine, Laurie Schatz, Carol Prior, Sabra Patterson and Marianne Black-Ruffin. Assistance was also gratefully accepted from Messrs. Bob Worth, Bill Sheridan and Roy Giampoli. Many difficult questions were answered by their fine technical support group that includes Messrs. Dennis Leong, Steve Sarna and David Butts.

Mss. Janice Glickson and Helen Kensick of David Todd Associates (the NEC-HE Public Relations firm) helped supply many of the illustrations and photos reproduced in this book.

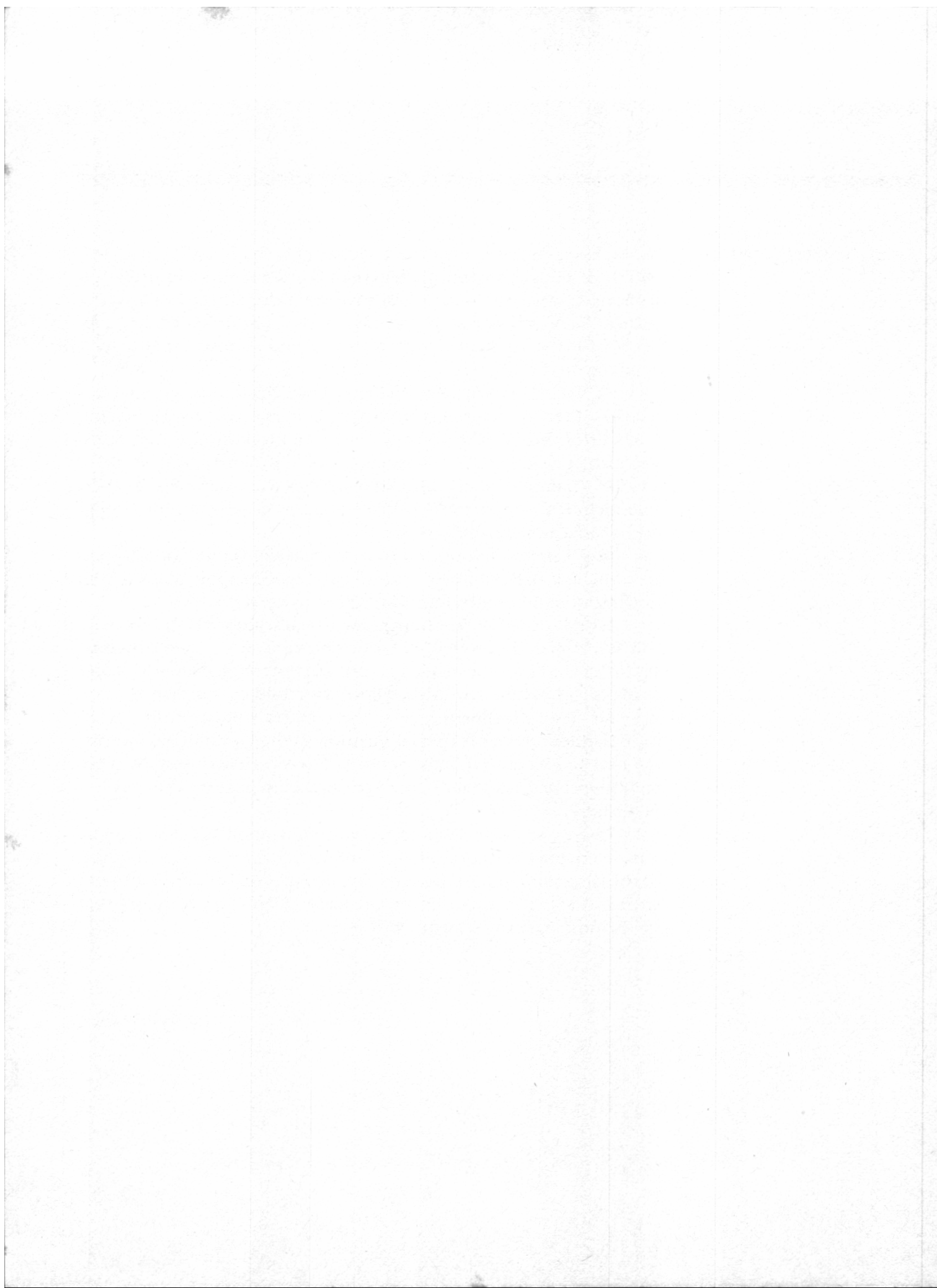
My editor, Dave Dusthimer, and his colleagues at Holt, Rinehart and Winston and Connie Kellner of The Publisher's Network must share the credit for the magic that translates a rough manuscript and crude sketches into the finished book you hold in your hands.

Mr. Fred Blechman, one of the country's most prolific technical authors, deserves special mention as the "godfather" of this, my first full-length computer-oriented book. His wisdom in these matters proved invaluable to a tyro inexperienced in the ways of publishing.

Lastly, my wife Reva is to be commended for her support during the long gestation period. I recall being by her side for each of the three nine-month periods that brought our children into the world. It seems fitting (but nevertheless deeply appreciated) that she helped share this "birth" with me.

Marvin Mallon





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## Preface

Computers, like many miracles of technology, have come a long way in a short period of time. Unlike the airplane or television, however, they started big and evolved into the compact marvels we see today. Back in the '40s, computers began as 747's and have now reached the Piper Cub stage. Where once they filled rooms they now reside comfortably in your hand, while still retaining much of the power (and more speed) than they had forty years ago. It has been a long technological step from the ENIAC of that earlier time to the personal microcomputer of today. Many inventions and developments contributed to this situation but none so dramatically as the introduction of solid state electronics - the transistor and all that came after it.

Within the last ten years we have witnessed the dawn of the microprocessor and the host of machines spawned by that creation. It is less than two years since the portable (more appropriately, "luggable") computer reached the market. Further shrinking of the computer architecture (along with a host of clever innovations) has now produced the briefcase-sized computer. This book is about one such device, the NEC PC-8201A. This superbly compact microcomputer, having the same width and length as a sheet of notebook paper and weighing less than four pounds, is one of a number of micros manufactured in Japan and sold in the U.S. The Tandy Corporation markets a nearly identical version as their Model 100. Olivetti, Kaypro (and others) will soon introduce similar machines and a proliferation of "lappables" is certain to occur during the next 12 months.

Whether you already own a NEC PC-8201A or are thinking of buying one you should know what it can, and cannot, do. It is by no means a replacement for its "big brother" the desk-sized personal computer. With its larger (and more legible) screen, the standard PC's do permit the running of accounting programs, database generators and a host of other valuable software that are ill-fitted to the NEC PC-8201A. Similarly, the "compact" personal computers are capable of much more than is NEC's little wonder. That's not surprising granted that they are simply 36 pound versions of the desk models with a carrying handle attached.

What the NEC PC-8201A can do, however, is remarkable enough. It has complete portability, meaning that its internal batteries permit its operation anywhere. Its non-volatile memory stores all of your entries even after the power switch has been turned off, a feature lacking in the larger machines. Telecommunications, bar-code reading and cassette storage are some of the

additional major virtues of the NEC PC-8201A. Perhaps its usefulness as a lap-size word processor is its strongest feature. In any event, it performs beautifully the tasks for which it was created, namely as a multi-purposed instrument for "people-on-the-go".

Recognizing that you may not be an experienced computer user, this book attempts to explain the operation of the NEC PC-8201A in an easily digestible manner. Where jargon is unavoidable it is defined immediately rather than requiring you to jump to a technical glossary. Clear-cut illustrations are used profusely to help make a point that words alone wouldn't cover adequately. In addition, useful appendices are included that chart many of the important graphics and programming functions. Hopefully then, this book will enable you to get full value from the machine by exploring function by function all the features it has to offer.

Marvin Mallon



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*PART* 1 The  
Machine

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# CHAPTER 1 Surveying the Keyboard

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## WELCOME

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You have just invested in a remarkable, bantam-weight microcomputer, the NEC PC-8201A. If this is the first time out of the shipping box for your new electronic helpmate, it might be appropriate to run through the set-up procedure. A saying that dates back to the beginning of the microcomputer age states, "If all else fails, read the manual." Rather than wait for something to fail or, worse yet, for some damage to occur, you are well advised to make your way through the *NEC PC-8201A's User's Guide*. This handy book (one of three that came with your unit) contains start-up information which can be condensed as follows:

1. Get 4 size AA alkaline batteries and place them in the slide-out battery cassette (Figure 1-1).
2. Switch the **Back Up Power** switch (located underneath the unit) to ON (Figure 1-2).
3. Slide the 0 OFF - ON 1 main power switch to ON (Figure 1-3).

Alternatively, if you purchased the optional NiCAD Battery Pack (part number PC-8201A-90) and/or the AC Adapter (part number PC-8271A-01), plug both of those units in as directed in place of step

1. A precautionary suggestion is to place a piece of masking tape over the **Reset** switch to prevent a catastrophic data "wipe-out" (Figure 1-4).

---

### ON/OFF and Contrast Controls

As you previously discovered, the ON/OFF switch is located on the right-hand edge of the NEC PC-8201A. If it's in the ON position but you don't touch the keyboard for about 10 minutes, the machine

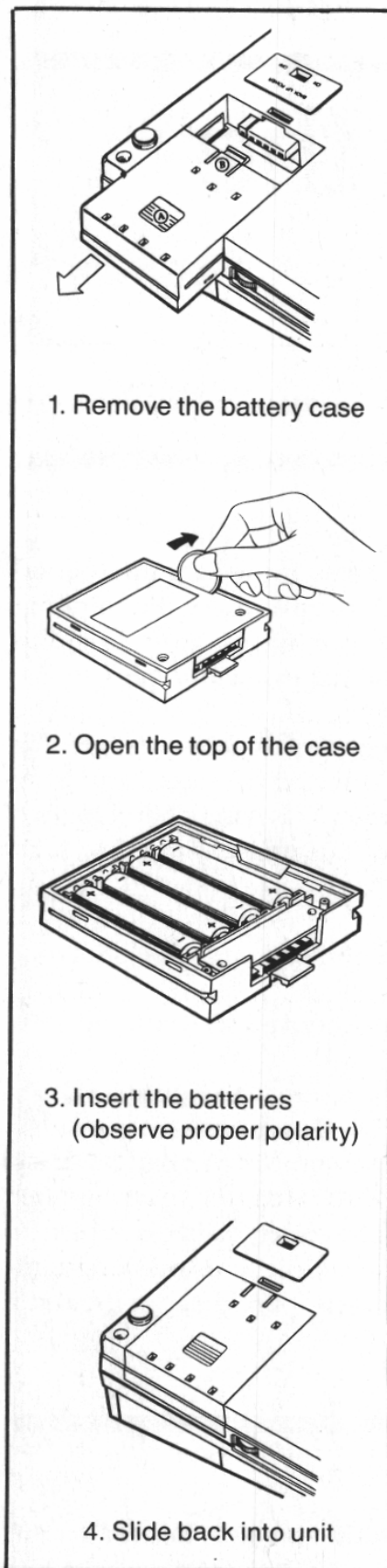


Fig. 1-1 Installing the Batteries

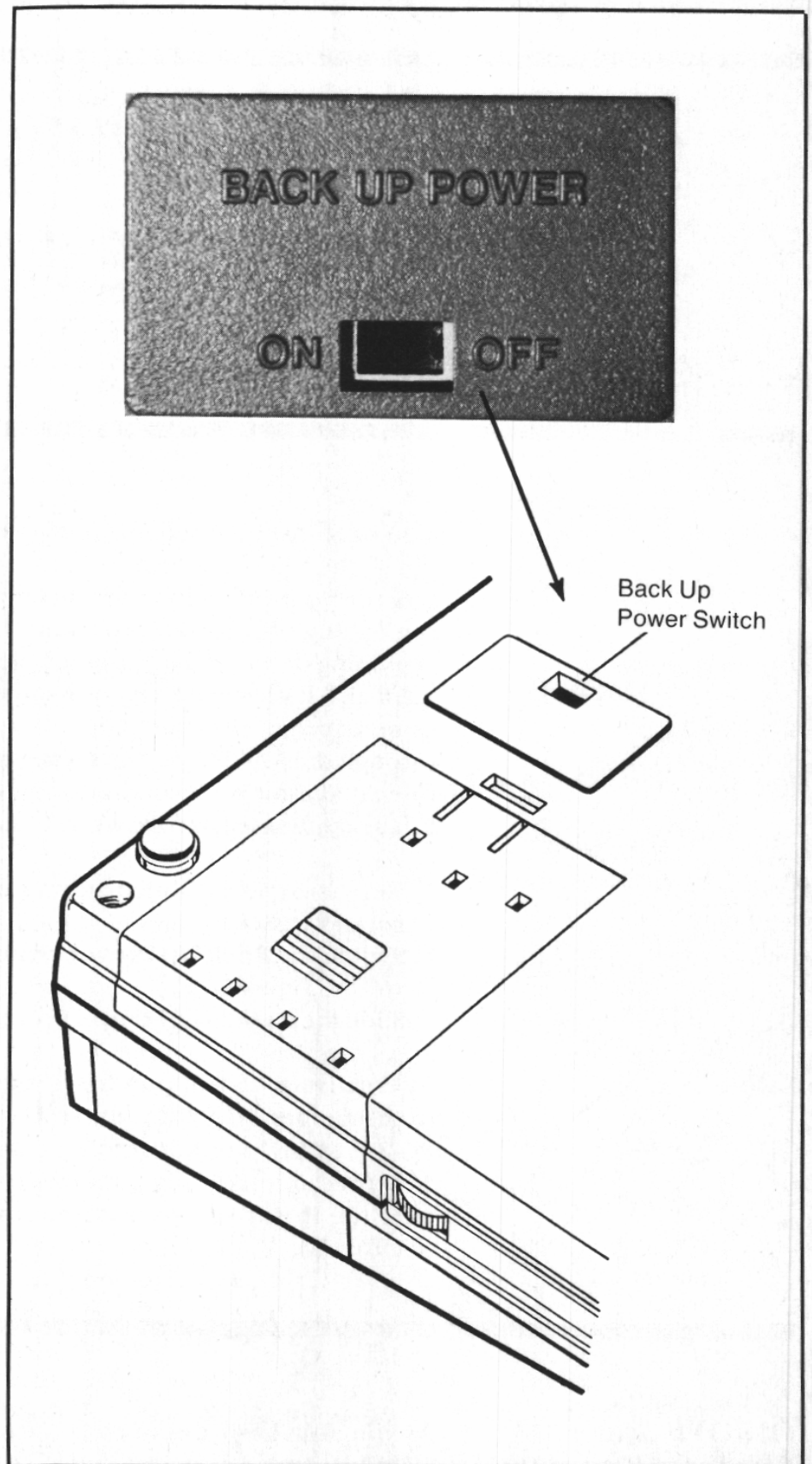


Fig. 1-2 The "Back-Up Power" Switch



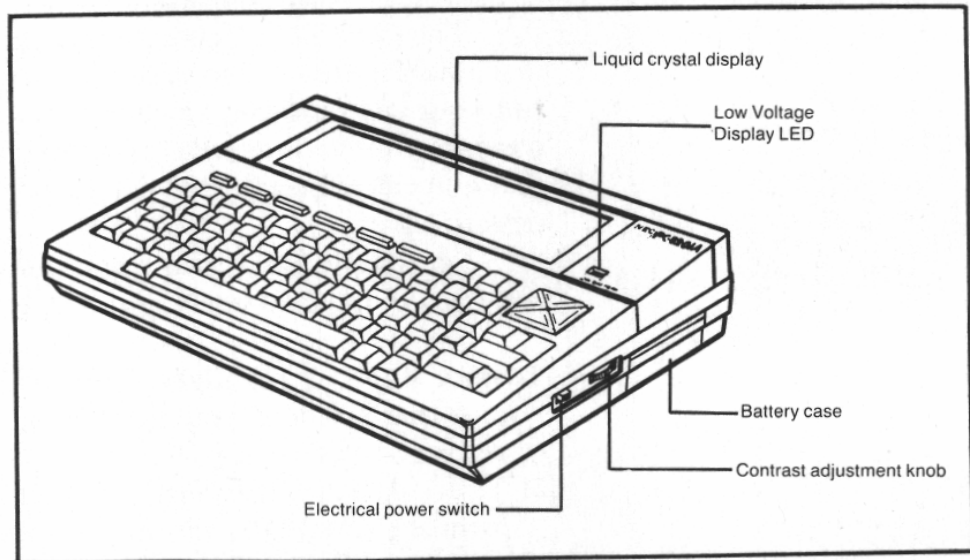


Fig. 1-3 The "Main Power" Switch and "Contrast" Control

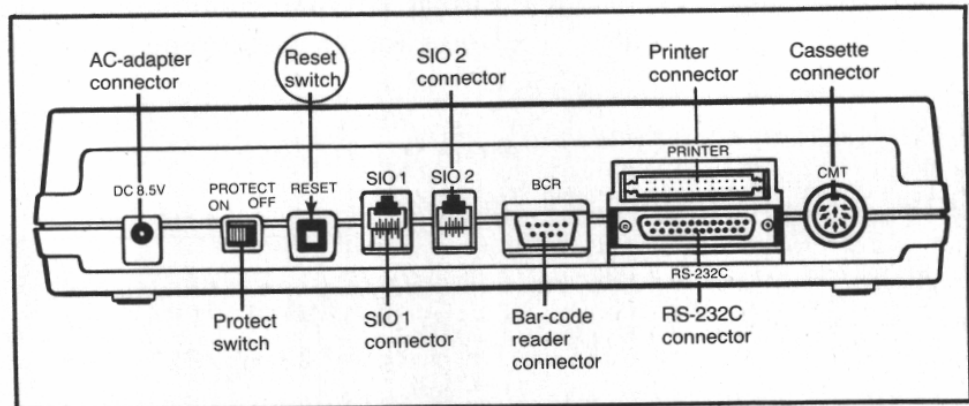


Fig. 1-4 The "Reset" Switch

will turn itself off to conserve battery power. It is then necessary to slide the ON/OFF switch back to OFF, and then to ON the next time you wish to activate the computer. This "time-out" feature can be set for other time periods or cancelled altogether. Refer to the POWER command as explained in chapter 7 or in the *BASIC Reference Manual* (another one of the three books that came with your machine). Any program material you might have entered into the machine will be retained. This automatic "shut-down" of the 8201A does not erase anything previously entered. Note that the NEC PC-8201A maintains the date and time. The built-in NiCAD back-up batteries keep the clock going and supply the small amount of power required by the internal memory. As long as the BACK UP POWER switch is turned ON, these batteries will do the job until they reach their end-of-life (approximately 2 1/2 years).

The CONTRAST control is also on the right-hand edge of the machine (Figure 1-3) and permits you to alter the LCD appearance to suit your taste and viewing angle. You can't hurt a thing by experimenting with various settings of this control. You will probably find that it needs to be adjusted when the NEC PC-8201A is moved from desk to lap.

Setting the correct date and time is the next order of business and is accomplished (see Figure 1-5) as follows:

1. Since BASIC is highlighted on the LCD (Liquid Crystal Display) and that's where you want to go, press the  $\leftarrow$  key (hereafter referred to as <enter>).
2. Type: date\$ = "83/05/01" <enter> using today's date in the format YY/MM/DD, mindful that the year comes first. It is necessary to enter two digits for each of the periods; for example, May becomes "05".
3. Type: time\$ = "14:07:30" <enter> using the correct time in the format HH:MM:SS and adding twelve to the afternoon hours. Don't forget the leading zeros, as shown in the date example above.
4. Type: menu <enter> and you'll exit BASIC and return to the Main Menu display.

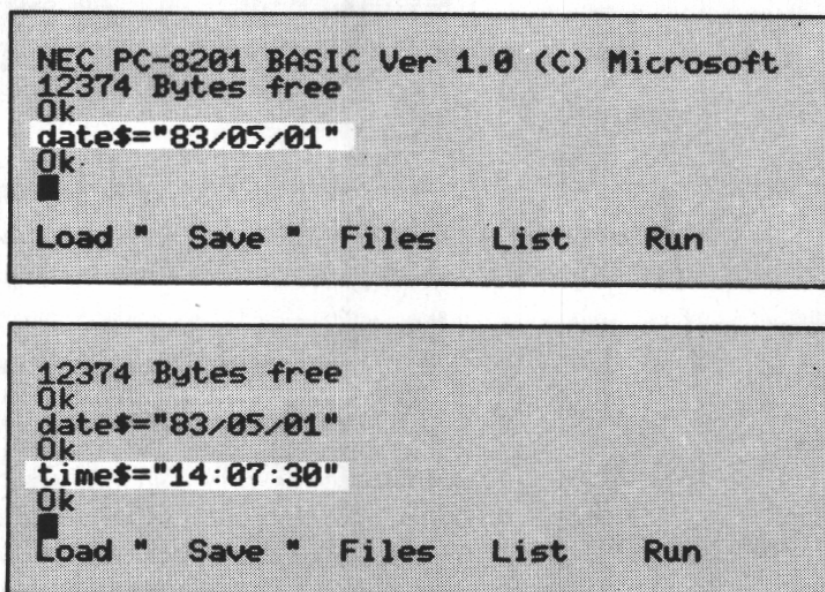


Fig. 1-5

Hereafter, your NEC PC-8201A will maintain the correct date and time. The procedure need not be repeated unless the internal NiCAD batteries require replacement.

We are now ready to begin our survey of the keyboard and

other important controls. Figure 1-6 illustrates that the keyboard occupies fully two-thirds of the face of the computer.

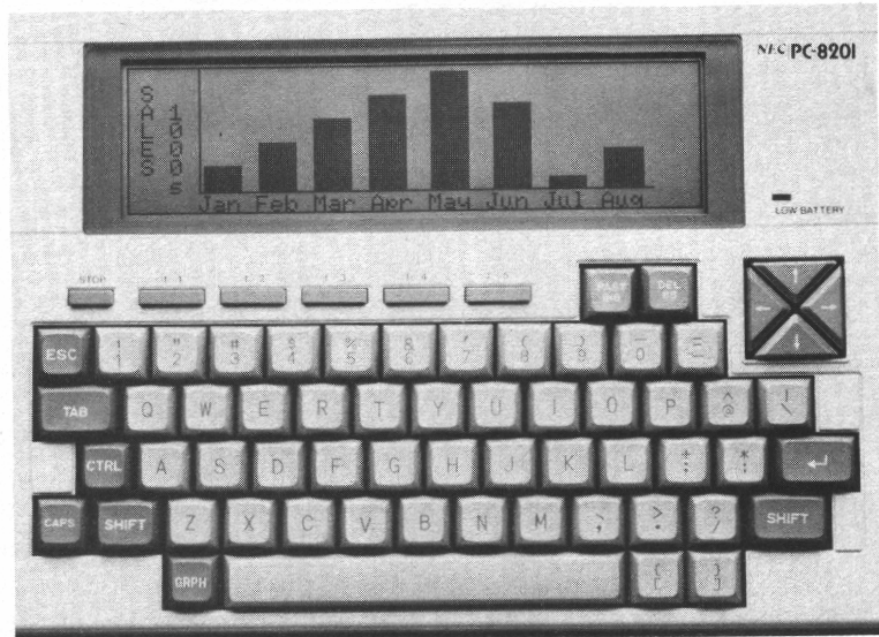


Fig. 1-6 The NEC PC-8201A

## The QWERTY Keyboard

There are 47 light-beige keys that constitute the main typing portion of the keyboard (Figure 1-7). The entire alphabet, as well as numbers, punctuation marks, special characters and the space bar are represented here just as they are on most typewriters. A few of the symbols and the location of others may differ from what you see on your Smith-Corona, but, by and large, this is the same keyboard you've worked with before. There are even raised bumps on the F and J keys to help touch-typists find the "home" position. Be assured that you can't hurt the computer by touching the keys.

A few of the symbols are notably different than those you may be familiar with. Their presence is explained principally because of their usefulness in creating BASIC programs. The < and > symbols represent the mathematical terms "less than" and "greater than". The asterisk is still an asterisk, but doubles as the sign of multiplication in BASIC programming. The pairs of brackets and braces, found in the lower right-hand corner, have no special meaning but are generally used in conjunction with parentheses when creating "nested" formulas.



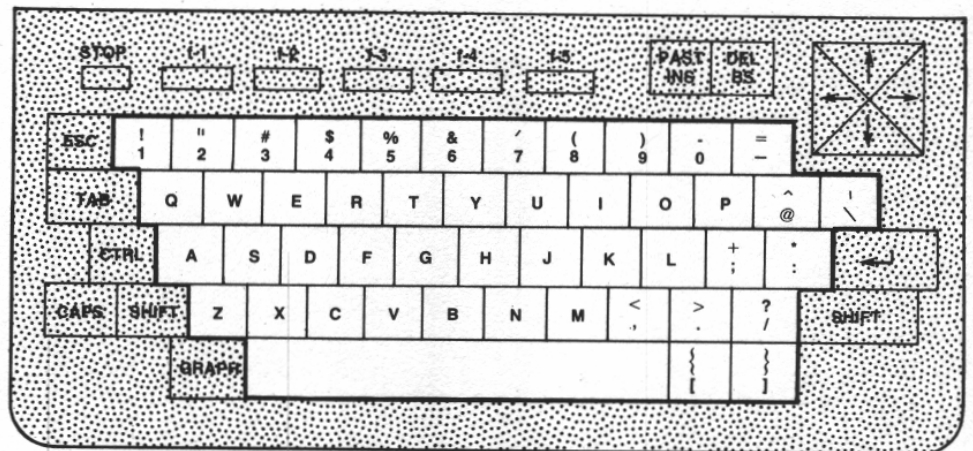


Fig. 1-7 The "QWERTY" keyboard.

QWERTY derives its name, of course, from the first six letters on the second row. Other, more efficient keyboards have been designed (notably the DVORAK) but it seems evident that the QWERTY is too ingrained in our culture to permit variation.

As on a typical typewriter, a right and left shift key can be found at the ends of the fourth row (Figure 1-8). Either one will put you in the capital letter mode or, if you are at the Main Menu, show you what function keys f-6 through f-10 are for. A more complete discussion of these keys and the display in general lies ahead. A "press on-press off" CAPS key serves to go from uppercase to lowercase while the  $\leftarrow$  <enter> key performs much the same function as the RETURN key. The TAB key also acts in a manner similar to typewriter operation. Pressing it advances the cursor (the blinking black square) eight spaces to the right. After the fourth tabbing to the right, the cursor advances one line and returns to the

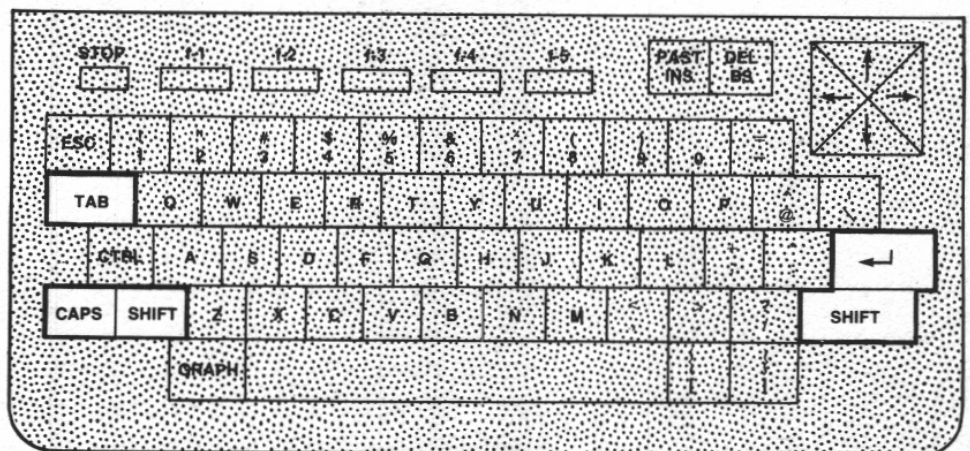


Fig. 1-8 The CAPS, TAB, "enter" and SHIFT keys.



left-hand edge of the display. TAB is used with TEXT, the built in word-processing program (more on that in chapter 8) and in BASIC programs only.

The key labeled CTRL (control), (Figure 1-9) located on the left-hand edge of the third row, is never used by itself but performs special functions in conjunction with other keys. For example, the combination of pressing the CTRL key and the letter G simultaneously will "beep" the NEC PC-8201A's internal sound system. A complete chart of control key functions can be found in Appendix A at the back of this book.

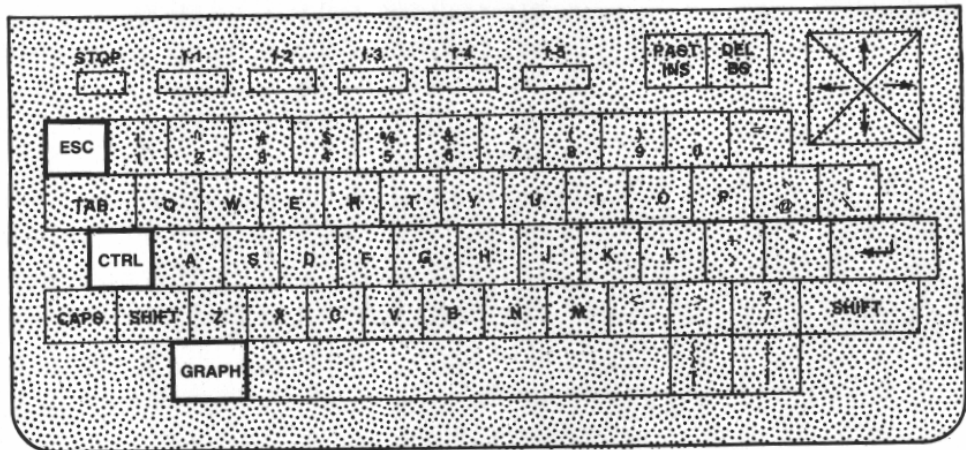


Fig. 1-9 ESC (escape) - CTRL (control) - GRPH (graph) keys.

The ESC (escape) key in the upper left-hand corner similarly provides special functions when used in conjunction with other keys. It doesn't do anything by itself, but it does provide a means for inhibiting scrolling, for changing the display from black letters on a clear background to the reverse (and back again) plus a number of other interesting and useful effects. A table of escape sequences is located in Appendix B.

The GRPH (graph) key is located in the lower left-hand position of the keyboard. When in BASIC it can be used to display three different graphic symbols, ◀, ◀◀ and ■, when pressed in combination with the letters Z, X and C, respectively. In addition, it is possible for you to create an infinite variety of special characters, capture them in the machine and have them available, in sets of 61, whenever you wish. They may be displayed by pressing the GRPH key in combination with other keys and/or by designating them from within a BASIC program. Some very interesting symbology can be created in this way if you wish to invest the necessary

programming effort. The method for accomplishing this is explained fully in the section in chapter 10 devoted to the CHRDEF (CHaRacter DEFinition) program supplied on cassette.

## Programmable Function Keys

Located just beneath the LCD display are the five programmable function keys (Figure 1-10). Since each can serve double duty, there are really ten different uses for these very special keys. When in the Main Menu, the commands **Load**, **Save**, **Name** and **List** are seen on the bottom line of the display. These functions can be invoked by pressing the related function key; f-1 through f-4. Pressing the f-5 key will only draw a "beep" as an indication that that key serves no function at that moment. If either of the SHIFT keys are depressed, the display of that line changes to read "SetIPL", "ClrIPL", "Kill" and "Bank". These are the functions that can be invoked by pressing the SHIFT key and either the f-1, f-2, f-4 or f-5 keys which, in reality, "move up" to be f-6, f-7, f-9 and f-10. Just remember that the SHIFT key will change the display line to indicate what the next five functions might be, and permits the function keys to start that action.

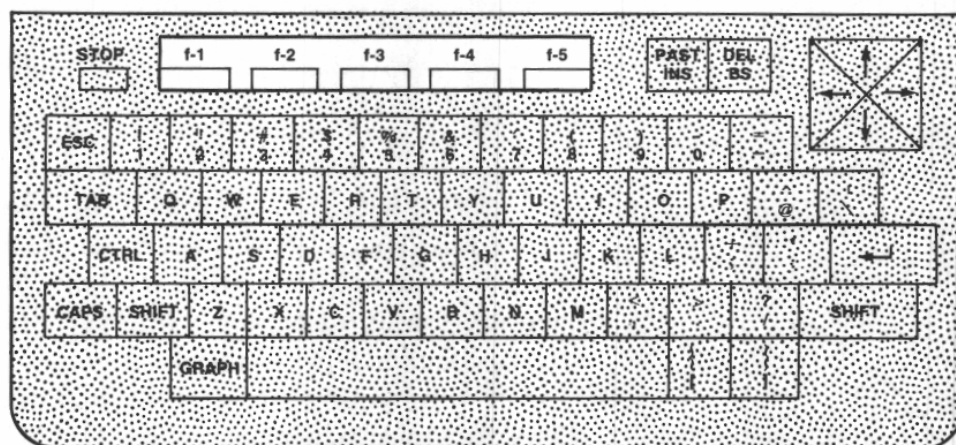


Fig. 1-10 The five "double-duty" FUNCTION keys.

### Load

The function performed by the f-1 key from the Main Menu is identified as **Load** (Figure 1-11). This action is used when it is desired to input information from an external source to the memory of the NEC PC-8201A. For example, many useful programs are supplied on

cassette tape along with the machine. A complete description of them is contained in chapter 10. During the discussion of those programs you will be instructed to *download* various files (move data from the cassette recorder to the NEC PC-8201A). It is this **Load** command that is used to accomplish that. **Load** can also be invoked when information is to be introduced directly to the machine through the COM (RS-232C) port, found at the rear of the computer.

This **Load** command is not to be confused with the **LOAD** or **CLOAD** command available in BASIC. The BASIC commands are explained more fully in chapter 7.

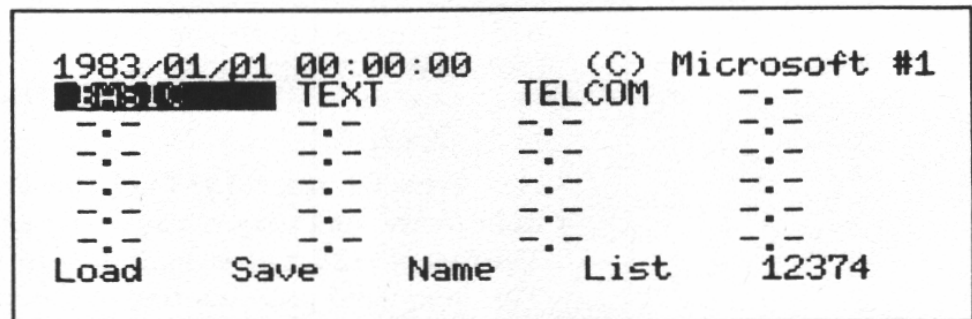


Fig. 1-11 The Main Menu Display

### Save

The f-2 key, when depressed, starts the **Save** routine. This action is just the opposite of **Load**. You can, through this command, save a file that you created on the NEC PC-8201A out to the cassette or through the COM port to an external storage device. This duplicates the action to be found in TELCOM, the versatile, built-in telecommunications program that is discussed in detail in chapter 9. *Upload* is another term for **Save** that you will run across as you explore the NEC PC-8201A.

### Name

The **Name** function serves only one purpose. If you move the cursor (the long, dark shadow behind a file name) over any selected file on the display and then press the f-3 key, you will be asked what new name you would like to use to replace the highlighted one. Movement of the cursor is accomplished by pressing the space bar. Each touch advances you to the next file on the Main Menu. Anything you type in (up to six characters) will then replace the previous name. This feature can be useful for personalizing the names of previously created programs or for adding some revision code to those that have been modified.

### List

You can print out any file shown on the display that ends with the letters BA (for BASIC program) or DO (a DOcument file created by the TEXT program) by moving the cursor over that file name and pressing the f-4 key. You are first asked for the **List Width** with 20 being the value supplied by the program, (any number from 10 to 132 is valid). When you reply "Y" to the question "List (your filename) Ready?" that program will be printed out through the parallel printer port found at the back of the machine. Of course, your printer should be plugged in, "selected" and ready to go or the NEC PC-8201A will simply "hang-up", waiting for your printer to be receptive to its output. This action can, if necessary, be aborted at any time by simultaneously pressing the SHIFT and STOP keys. A BASIC program can also be listed out to your printer by other means discussed more fully in chapter 7.

### SetIPL

Pressing either SHIFT key changes the last line of the display to indicate the functions of the f-6 through f-10 keys (see Figure 1-12). The first of this group is the SetIPL (Initial Program Load) command. This command provides one of the most useful functions that the NEC PC-8201A is capable of. Through its use you can instruct the machine to move directly to a specified task whenever it is turned on. Instead of the normal Main Menu display, it is possible, for example, to have the computer first request a secret password from the operator. If the proper password is not given, the machine turns itself off, thus guarding against unauthorized use. The steps that are necessary to accomplish the scenario just described are as follows:

1. To create the IPL file: Place the cursor over the TEXT file and press <enter>. Respond to the "File to edit?" question by typing IPL.
2. Type in the following on separate lines:  
BASIC<enter>  
CLS:INPUT X\$:IF X\$<> "MYPASSWORD"THEN POWER  
OFF ELSE MENU <enter>
3. Press the SHIFT and f-5 keys to return to the Main Menu.
4. Position the cursor over the file you just created which is now entitled "IPL.DO". Press the SHIFT and f-1 keys simultaneously and you'll note that the name has been changed to "IPL\*DO", indicating that you have activated that file as an Initial Program Load file.
5. Turn the machine OFF, wait a moment or two, and turn it back ON.



After a series of quick display changes, you will see only a question mark (?) on the screen. The IPL routine has been invoked and the 8201A is asking you for the correct password. If you type in anything other than MYPASSWORD, or whatever secret word you chose to use, the machine turns itself off. It can be turned on again, but any wrong response will produce the same results. The right password does move you to the Main Menu.

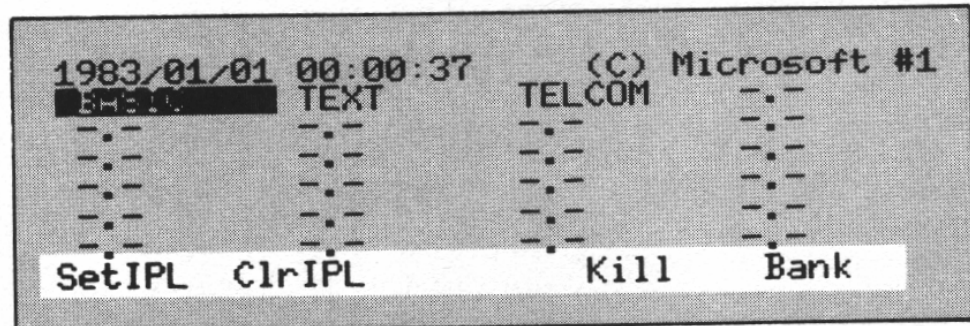


Fig. 1-12 The Main Menu Display (Shift Key depressed)

Another example of the use of the IPL function demonstrates how you can “jump”, directly on start-up, to a previously created and maintained message file. Thus you would be presented with your “Things-to-do” list everytime you turned the machine on. This can be implemented by following these steps:

1. To create the IPL file: place the cursor over the word TEXT, press <enter> and answer the “File to edit?” query with START <enter>.
2. Type in the following:  
TEXT <enter>  
TO.DO <enter>
3. Press the combination SHIFT/f-5 to return.
4. Move the cursor again to the word TEXT and press <enter>.
5. Answer the “File to edit?” question by typing:  
TO <enter>.
6. Type in anything that you might like to keep on record, such as “Lunch with Fred on Tuesday” <enter>.
7. Press SHIFT and f-5 in combination to return to the Main Menu. You have just created a text file called TO. Since all such files have the suffix .DO appended to them, it appears as TO.DO (an appropriate title).
8. Place the cursor over the file entitled START.DO and press SHIFT/f-1.



9. Turn the machine OFF. The next time you turn it on, you will be greeted by your electronic memo pad. A SHIFT/f-5 will get you to the Menu.

This powerful, self-executing capability of the NEC PC-8201A is limited only by the requirement that the first command be either BASIC, TEXT or TELCOM. As you learn more about both the versatility of BASIC programs and the potential of TELCOMmunications you will most likely invent some clever uses for SetIPL.

### **ClrIPL**

This simple function is invoked by the simultaneous pressing of the SHIFT key and f-2. It cancels any previous IPL file that may have been created. It doesn't delete it but rather nullifies it as being automatically executed at turn-on. It is not necessary to be positioned over the IPL file name in order to cancel, nor is it necessary to use ClrIPL to cancel one such file before creating another.

### **Kill**

The **Kill** function allows you to delete any files (other than BASIC, TEXT or TELCOM) that you might wish to purge from the memory of the machine. Since the NEC PC-8201A has limited capacity for internal storage, it is inevitable that at some point you will need to erase a text file or BASIC program in order to make room for a more current item of interest. As will be described in chapter 4, it is possible to transfer such files to a cassette tape prior to deleting them. Thus they could be restored whenever they are needed.

To KILL any file, it is only necessary to position the cursor over that file and press the SHIFT/f-4 combination. You will be asked "Kill (filename) Sure?", giving you an opportunity to abort this operation before irrevocably removing an important bit of work. A "Y" response removes the file from the Main Menu, and the amount of work space available to you (as designated by the number in the lower right-hand corner of the display) increases accordingly.

### **Bank**

The last special function that is available from the Main Menu is **Bank**. This is the f-10 command and is accomplished by pressing the SHIFT/f-5 keys. It is used to shift from one bank of memory to the next. If your machine has not been expanded to either two or three banks of memory, then this command does nothing. A further discussion on add-on memory can be found in chapter 6. Three programs, supplied on cassette, that make use of multiple banks are described in chapter 10.

## Cursor Control

Figure 1-13 identifies the location of the *cursor cluster*, a rather unique and handy arrangement of four keys whose only function is to move the cursor either right or left, up or down. Their function in the Main Menu duplicates that of the space bar but allows you to move from row to row on the display as quickly as you can move from left to right. In the TEXT program (discussed in chapter 8) and in BASIC, they permit efficient placement of the cursor; something no other combination of keystrokes could provide.

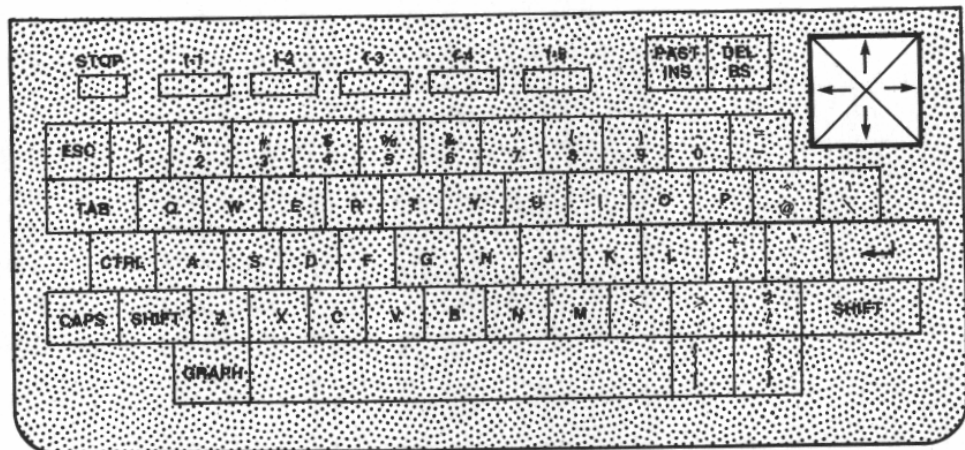


Fig. 1-13 The Cursor Control Cluster

## Miscellaneous Keys

The last three keys to be surveyed are the STOP, PAST/INS and DEL/BS keys (Figure 1-14).

### Stop

As its name implies, the STOP key halts operation under certain circumstances. When RUNNING a BASIC program, the STOP key will terminate the program and produce a "Break in xxxx" message. If printing has been invoked, then the combination of SHIFT and STOP will halt that activity. In the TEXT program, it will return you to the Menu display if pressed in response to the "File to edit?" question. In general, it can be counted on to get you out of whatever is going on should you wish to halt an operation.

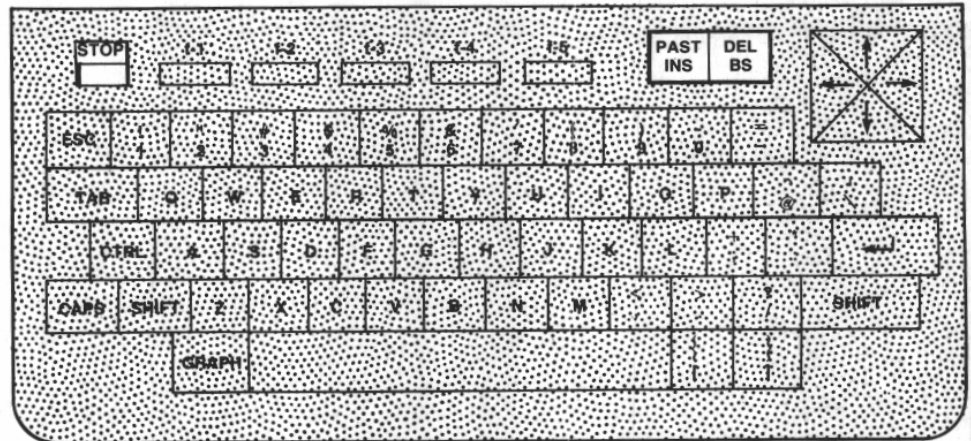


Fig. 1-14 The STOP - Paste/Insert - Delete/Backspace Keys

### Past/Ins

This key is found to the right of the f-5 key and performs two distinctly different operations. When in BASIC, it provides for the INSertion of text when pressed. If pressed again, the insertion mode is cancelled. This function permits the efficient editing of BASIC programs. When used with the SHIFT key, it performs the PASTe function in the TEXT (word processing) program that is examined in depth in chapter 8.

### Del/Bs

You may have already discovered that the BackSpace key acts as your electronic eraser. Each stroke causes the cursor to back up one space and "eat" the character that was in its path. This handy correction feature is available at all times and in all program modes. The SHIFT key changes this into a DELEte key. DELEte pulls characters on the display in from the right rather than moving the cursor to the left. The shifted and unshifted use of this single key lets you do most any editing task quickly and efficiently.

Other than the liquid crystal display, the only remaining item of interest on the face of the 8201A is the LOW BATTERY indicator (see Figure 1-15). As the NEC *User's Guide* cautions, "If the main batteries have a low charge, causing the backup battery system to be used, the LOW BATTERY LED indicator will light up. You should change the batteries when this indicator lights up, since you can only operate the PC-8201A for about 20 minutes from this point. Storing the PC-8201A for a long time with a low charge will cause it to become inoperative."

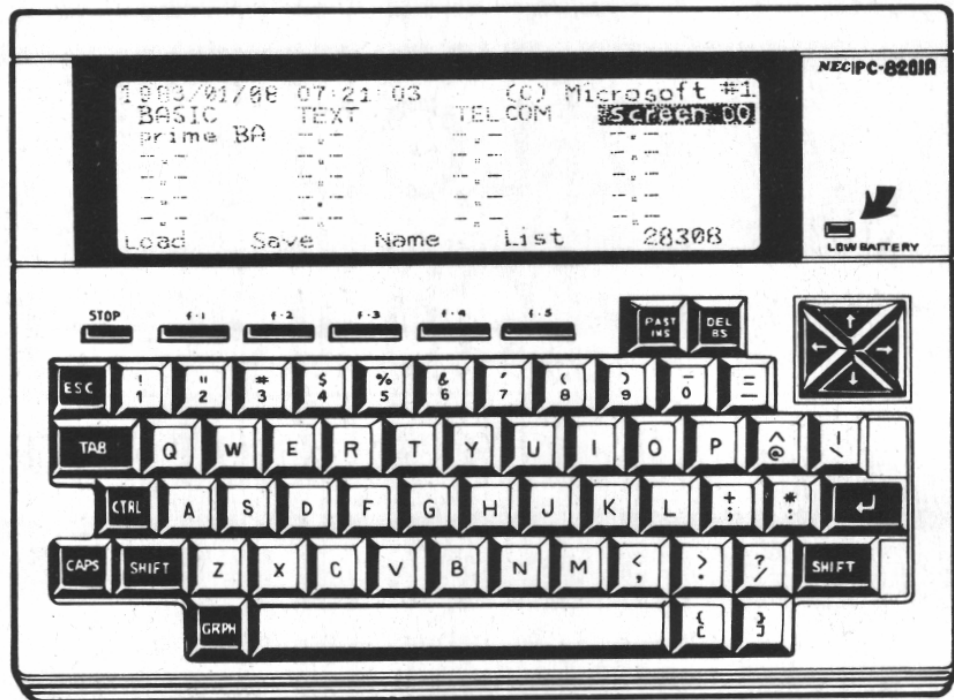


Fig. 1-15 The "Low Battery" Indicator

## Summary

Our survey of the keyboard is complete. All 67 keys have been discussed and we are ready to move on to some productive activity on the machine. A further exploration and demonstration of all keys is part of the chapters that follow.



---

## CHAPTER 2 LCD

# Characteristics

### THE LIQUID CRYSTAL DISPLAY

---

In chapter 1 we toured the 8201's keyboard which comprises nearly two-thirds of its working surface. The remainder of the face of the machine is devoted to its unusual display which utilizes the technology of liquid crystals (Figure 2-1). While displays of this sort are nothing new (they have been a major component of almost every hand-held calculator produced in the last decade) it has only been with the advent of this machine (and its Radio Shack Model 100 twin) that the display size has reached such proportions. The usable face of the display measures two inches by seven and a half inches and thus has room to show eight lines of 40 characters each. Each character is, in reality, comprised of many points that form the character desired (Figure 2-2). This dot-matrix concept is not unlike that which is employed in the more popular high-speed printers; companions of such machines as this. A further understanding of some of the technical aspects of the LCD (liquid-crystal display) may help in your appreciation of the NEC PC-8201A as well as aiding in some of your programming efforts.

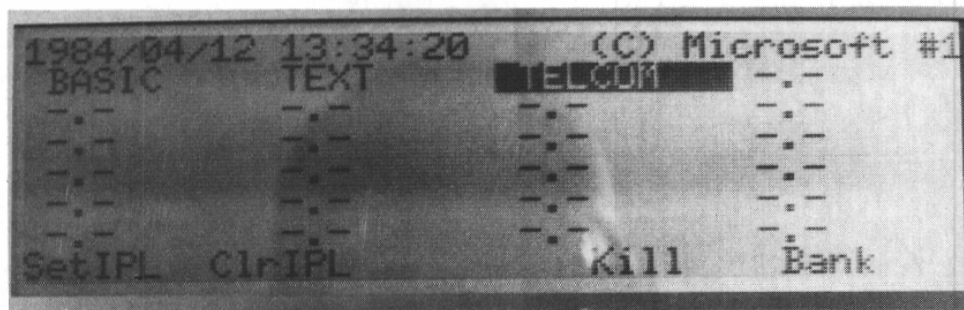


Fig. 2-1 The Liquid Crystal Display (LCD)



```

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890-!"#$%&'()*_ =
^I@ \+* ; : < > ? , . / ( ) [ ]

```

Fig. 2-2 The NEC PC-8201A Character Set

## The Nature of LCD's

Liquid crystals are substances whose molecular structure changes in the presence of an electric field. By controlling the *cells* of the display at various locations, it is possible to form letters, numbers and other symbols. A liquid crystal scatters light that shines on it and is not a source of light itself. Unlike the more common TV type of cathode-ray tube display, the liquid crystal display can only function in the presence of extraneous light—the more, the better. The contrast level of an LCD can be adjusted by altering the voltage across it. This has the effect of changing the viewing angle as well. Though the NEC PC-8201A has a 15 degree sloping angle to its face to provide easy viewing, this contrast adjusting feature was added to accommodate other working positions of the unit.

## Size and Resolution

The 8201 can display eight rows of 40 characters each. Each such character occupies a cell made up of a six by eight matrix of individual dots (Figure 2-3). These “dot” locations are more accurately

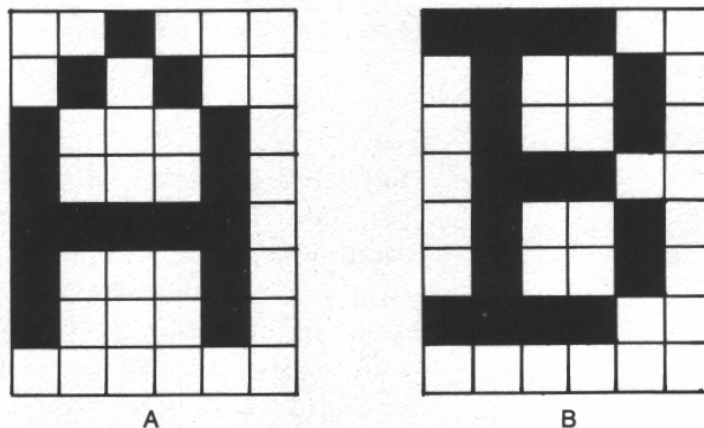


Fig. 2-3 Typical Pixel Arrangement for Creating Alpha-Numeric Characters.

identified as *pixels*, a term peculiar to computer graphic displays. In the NEC PC-8201A, each pixel can be individually addressed and either turned *on* or *off*. This is accomplished from within BASIC, the high-level programming language built into the machine. A simple demonstration of this capability can be accomplished in the following manner:

1. With the cursor positioned over the word BASIC on the Main Menu, press <enter>.
2. Type in the following: (all in one line)  
`10 CLS:FOR Y=0 TO 3:FOR X=0 TO 216:PSET(X + Y*8,X MOD 31 + 18):NEXT X,Y <enter>`
3. Press the f-5 key (**Run**). Diagonal lines will form a pattern (Figure 2-4).
4. Press the f-2 key (**Save**) and type in PIXEL <enter>.



Fig. 2-4 Pixel Test Program

Repeated pressings of the f-5 key will re-run this simple demo program. The SHIFT/f-5 combination will return you to the Main Menu where you will note a new file identified as PIXEL.BA on the display. You have just written (and saved) your first BASIC program. You can jump directly to this program anytime you wish, by simply moving the Main Menu cursor over the filename "PIXEL.BA" and pressing the <enter> key. You can also KILL this file from memory by using the SHIFT/f-4 combination described in chapter 1.

We will explore this graphics capability further in the section

dealing with BASIC programming. Each of these 15,360 pixels can be programmed to *light up* or *turn off*, creating some useful histograms and other geometric patterns.

## Scrolling

Though the display has room for eight lines of text, the last line is typically reserved to indicate the purpose of the function keys or for certain relevant queries in response to your selections. Consequently, in normal operation while in BASIC, the display will *shift up* (or scroll), one line at a time, as new lines of information are added at the bottom. This action can be inhibited, if desired, to prevent all but the last line to be “frozen” and not disappear from view. To best demonstrate this action, which may prove useful in your own programming efforts, do the following:

1. Enter BASIC from the Main Menu (press <enter> when the cursor is on the word BASIC).
2. The display will appear much as it does in Figure 2-5.
3. Repeatedly press the <enter> key and watch the first few lines vanish off the top of the screen.
4. Type CLS <enter> to clear the screen and bring the word “Ok” to the top of the screen.
5. Simultaneously press the SHIFT key, the letter “v” and the ESC key. This is known as an *escape sequence* and causes the scrolling action to be inhibited.
6. You will now find that pressing the <enter> key will take you to the seventh line but no further and that the word “Ok” can still be seen at the top of the screen.
7. The escape sequence, ESC/SHIFT/w, will reactivate the scrolling mode as will returning to the Main Menu by invoking SHIFT/f-5 (exit BASIC).

```
NEC PC-8201 BASIC Ver 1.0 (C) Microsoft
12374 Bytes free
Ok
■
```

```
Load "   Save "   Files   List   Run
```

Fig. 2-5 The Basic Display

This demonstration of how to control scrolling not only serves to acquaint you with this feature, but with the concept of escape sequences in general. They will be discussed again in the section devoted to BASIC (chapter 7). A table of various sequences also appears in Appendix B.

---

## Inverse Video

As the cursor of the Main Menu is moved from position to position, the various filenames change from black characters against a white background to the opposite. This "inverse video" capability is a feature that you, too, can control and make use of. It is another of the escape sequences that is available in BASIC and it can provide an attention-getting highlight capability. To demonstrate this action, take the following steps:

1. Enter BASIC
2. Press the ESC key and the letter "p" simultaneously.
3. Note that any typing will now produce clear characters against a black background. The same is true of messages echoed back by BASIC.
4. Press the ESC key and the letter "q" at the same time. The "normal" video display has now been restored. It would also have returned to a normal state if you had exited BASIC (SHIFT/f-5) and returned to the Main Menu.

---

## Summary

In this chapter you have learned that the liquid crystal display (LCD) is composed of over fifteen thousand programmable "pixels", each measuring approximately twenty-nine thousandths of an inch square. Taken as a block of six by eight, you can create an infinite variety of symbols, or simply utilize the alpha-numeric designs that correspond to the 97 characters of the keyboard. In addition, you can cause them to be displayed as black figures against a clear background or vice-versa. It is also possible to control the action of the display so that the normal scrolling action is inhibited and a "frozen" display can be programmed. This versatility, built in to the NEC PC-8201A, is implemented from within the BASIC programming mode and provides opportunities for clever graphic displays—limited only by your skill and imagination.



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# CHAPTER 3 The Communications Connection

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## INPUT/OUTPUT

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Though the NEC PC-8201A is a marvel of self-contained technology, its finest feature is its ability to work with numerous external devices. This “pathway” to the outside world multiplies the machine’s value considerably. The built-in word-processing program (TEXT) would lose its importance, for example, were it not for the 8201A’s ability to send its contents to a printer. The sophisticated version of BASIC that resides in the machine would be meaningless if you were not able to record your programming on a cassette or floppy disk. Similarly, the telecommunications package implemented in the machine is not feasible without a means to transmit over phone lines. All of these capabilities (and a few more) are contained within the architecture of the NEC PC-8201A. In this chapter, we will continue our exploration by examining, one by one, the ways and means by which this computer “talks” to the rest of the world. As Figure 3-1 illustrates, most of these communication

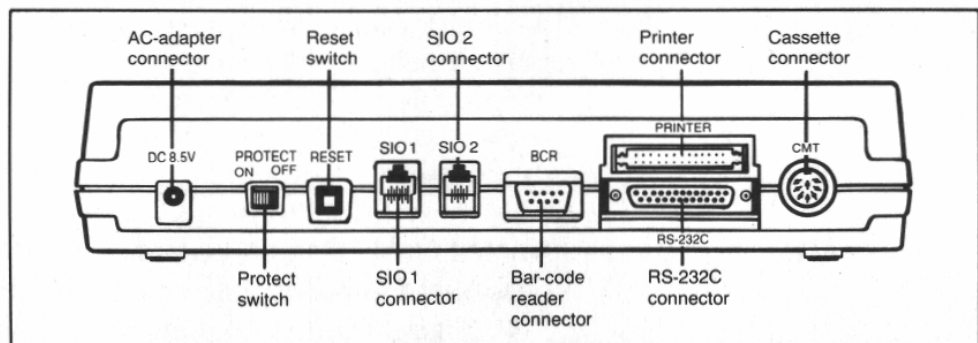


Fig. 3-1 The 8201A's Input/Output Connectors



lines are available at the rear of the machine in the form of various plugs and jack connections. Figure 3-2 identifies another communication line can be found on the left-hand side, the *system slot*.

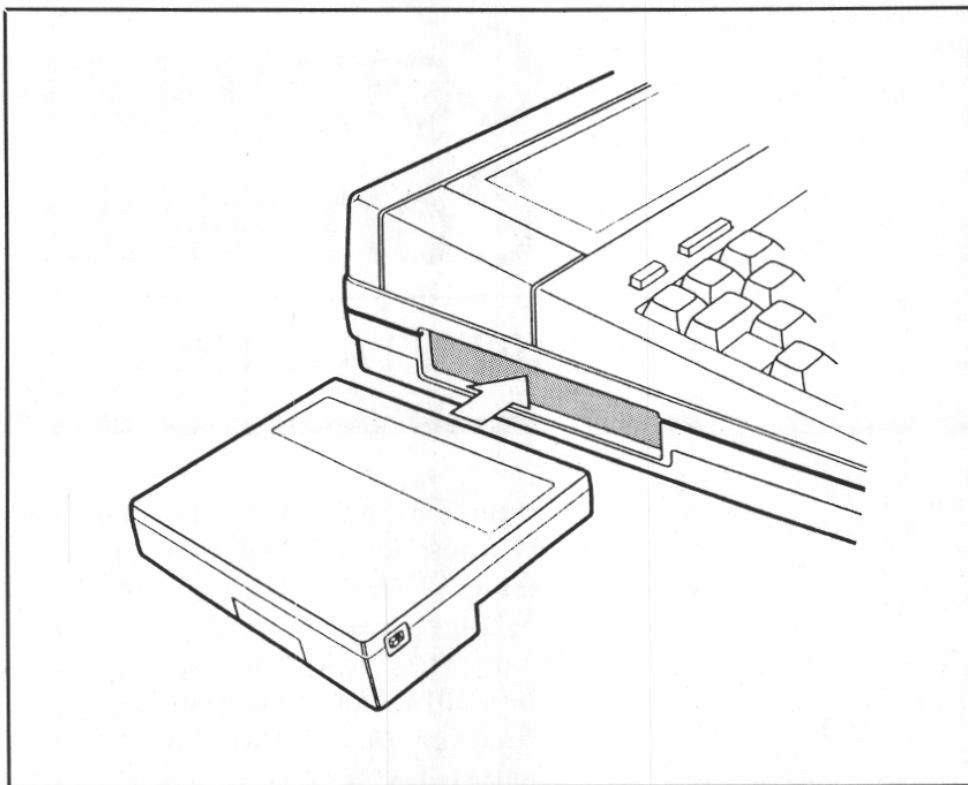


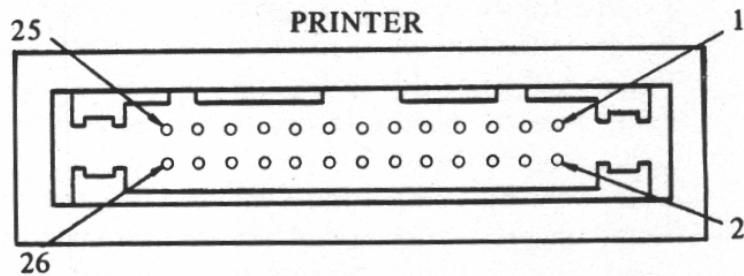
Fig. 3-2 The System Slot

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## Parallel Printer Port

Six different input or output connectors can be found at the back of the NEC PC-8201A. Though the AC adapter plug-in is located here as well, it doesn't really qualify as an I/O (input/output) connector. Its job is much more mundane than the ones under discussion in this chapter. The PROTECT and RESET switches, of course, aren't connectors at all and will be identified and discussed in other sections of this book.

Two plugs are located one above the other. The uppermost is labeled PRINTER and, as the name implies, is the means (but not the only one) for interfacing the 8201A with a hard-copy printer (Figure 3-3). This 26 pin male connector is meant to accept the optional parallel printer cable (part number PC-8294A). The cable terminates



Pin number	Signal name	Remarks	Pin number	Signal name	Remarks
1	STROBE	WRITE strobe	2	GND	Signal ground
3	PD0	Parallel data 0	4	GND	Signal ground
5	PD1	Parallel data 1	6	GND	Signal ground
7	PD2	Parallel data 2	8	GND	Signal ground
9	PD3	Parallel data 3	10	GND	Signal ground
11	PD4	Parallel data 4	12	GND	Signal ground
13	PD5	Parallel data 5	14	GND	Signal ground
15	PD6	Parallel data 6	16	GND	Signal ground
17	PD7	Parallel data 7	18	GND	Signal ground
19	NC		20	GND	Signal ground
21	BUSY	Printer busy	22	GND	Signal ground
23	NC		24	GND	Signal ground
25	SLCT	Printer select	26	NC	

Fig. 3-3 The Parallel Printer Port

in a 36 pin Amphenol Blue Ribbon plug and is commonly identified as Centronics printer compatible. In an industry notably lacking in standards, this plug configuration is one of the more popular exceptions. Virtually all of the low and medium-priced printers on the market feature this Centronics parallel connection. It is generally not a problem, therefore, to correctly interface with a host of various printers.

The range of printers that can be used with the NEC PC-8201A extends from high-speed dot-matrix machines to relatively low-speed daisy wheel printers and typewriters. NEC offers a battery-operated thermal printer (part number PC-8221A) that is a true portable companion to the 8201A.

No special "magic" is necessary to successfully attach most printers to the NEC PC-8201A. If the printer of your choice is Centronics compatible, and if you obtain the NEC cable, the mating of the machine and printer is assured. Your printer may, or may not, require certain internal switch settings of its own in order to provide proper operation, but that would be true regardless of the micro-computer you connected to it.

Once joined, the printer will respond to the **List** command found in the Main Menu (see chapter 1) as well as the LPRINT and LLIST functions that reside in BASIC. In addition, the printer functions under the command of various other programs and services available from outside sources. It is usually possible, for example, to have your printer echo the messages arriving on the 8201A's display from the numerous information services (CompuServe, Dow-Jones, etc.) as well as any of the free electronic "bulletin boards" that have proliferated throughout the country.

A direct, simple test of your printer can be accomplished by following these steps after the hook-up has been made:

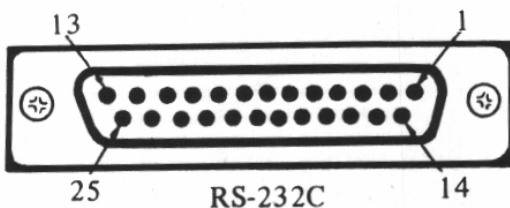
1. Enter BASIC
2. Type all in one line:  
FOR X=1 TO 5:LPRINT "The printer is working.":NEXT
3. Press <enter>. The message should print out (with proper line feeds) five times.

If the paper doesn't advance after each line, check the switch settings as described in your printer manual. If the printer doesn't respond at all, the 8201A is likely to "hang up" and can be brought back under control by pressing the SHIFT and STOP keys simultaneously. Check all cable connections and make certain that the printer is in the "select" mode. Once started, printing can best be halted by using the SHIFT/STOP combination.

## RS-232C Serial Port

One of the other fortunate standards to gain acceptance in the computer industry is the RS-232C protocol for serial input/output connections. The title, RS-232C, is the number of the document that is written into the proceedings of the committee that created the standard on behalf of the electronic engineering community. The term "serial" specifies that the flow of information proceeds like a train pulling one boxcar of data after another. This is the opposite of "parallel" which is analogous to eight trains moving simultaneously on parallel tracks. Either method delivers the data to the other end. Each method of information transmission has its advantages and disadvantages. Both are provided for on the NEC PC-8201A. The previously described, parallel printer port accommodates one method and the RS-232C connector provides the other.

Figure 3-4 portrays the location and pin connections of the RS-232C port. This 25 pin female connector will accept any of the



Pin number	Signal name	Remarks
1	GND	Protective ground
2	TxD	Transmit data
3	RxD	Receive data
4	RTS	Request to send
5	CTS	Transmission authorized
6	DSR	Data set relay
7	GND	Signal ground
8	DCD	Data carrier detect
20	DTR	Data carrier ready
22	RD	Bell detect
25	---	

Fig. 3-4 The RS-232C Serial Port



DP25 plug cable assemblies available in most retail computer stores or from NEC (part number PC-8295A-02). Most commonly, this port is used for connection to a telephone modem. *Modem* is an acronym which stands for “modulate-demodulate”, and describes any device that acts as both the sending and receiving interface for serially connected computers. Its principal task is to prepare the data for transmission over phone lines and, conversely, to take incoming data and make it presentable to the computer. Transmission can take place at different speeds and in various formats. The NEC PC-8201A has the capability to work directly with an external modem (such as the Authentic 300 MD shown in Figure 3-5). For this

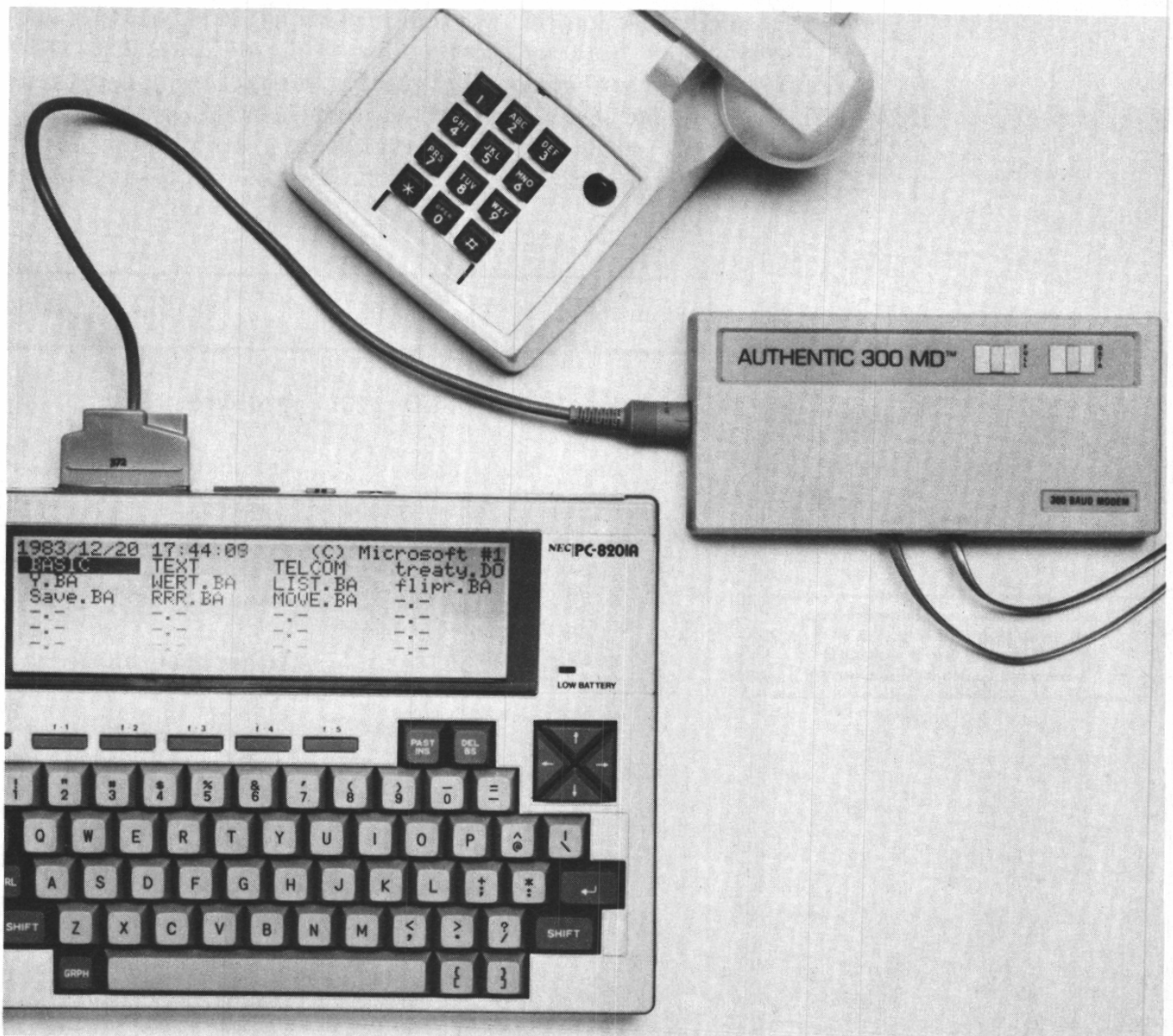


Fig. 3-5 The Authentic 300 MD Modem and PC-8295A-01 Cable



purpose, NEC offers a special modem communication cable (part number PC-8295A-01). A further discussion of this arrangement is covered in chapter 9 which deals with TELCOM, the telecommunications software resident in the NEC PC-8201A.

Some printers provide for only a serial connection and do not observe the more popular Centronics parallel interface. The RS-232C port is the only means on the NEC to "talk" to such printers. One way of doing so is demonstrated as follows:

1. Obtain a cable that properly mates the 8201A to your printer. The NEC PC-8201A requires a male 25 pin plug at its end. Your printer may be of either gender. Other connections may be required, but be certain that pin 2 of one end is wired to pin 3 of the other and vice-versa. These are the all important transmit/receive lines and must be crossed in this manner. Check your printer manual for other pin connections. One typical configuration is illustrated in Figure 3-6.
2. Set your printer protocols by whatever means is provided. Typically, this is accomplished by adjusting a number of "dip-switch" positions. One common arrangement is to set both the NEC and your printer for a transmission speed of 4800 baud (bits/per/second), Even parity, a 7 bit word length and 1 stop bit.
3. Prepare either a DO file (see chapter 8—dealing with TEXT) or a BA file (created by BASIC) on the 8201A.

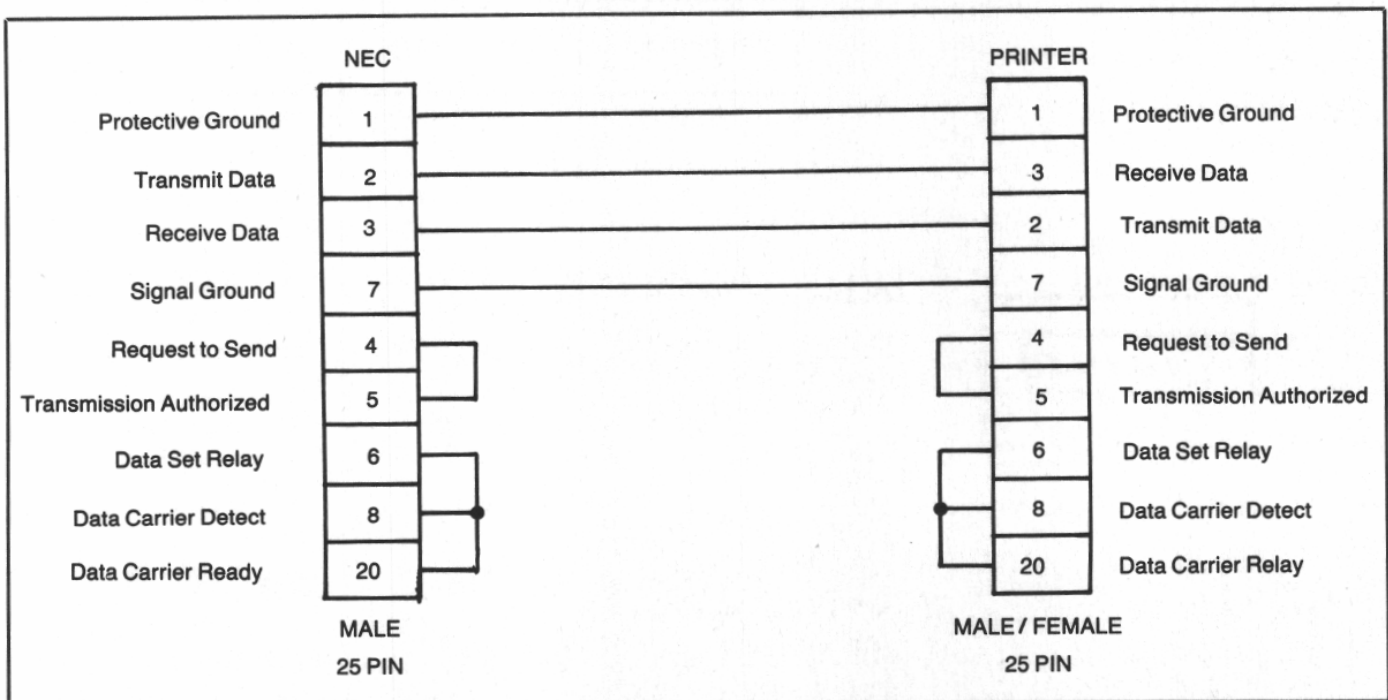


Fig.3-6 Typical RS-232C Serial Printer Cable Connections

4. Place the cursor over this filename and press the f-2 key.
5. Answer the question "Save <filename> as" with: COM:7E71NN<enter>. Answer "Ready?" with a Y and printing should commence.

In addition to modems and printers, a host of other peripherals may become available that will normally interface to the RS-232C connector. Joysticks, plotters and light-pens are possible devices that may, in time, be developed to work with the 8201A. It would not be unexpected that they will "plug in" to this universal port.

### Bar Code Reader Jack

The 9 pin Bar Code Reader jack is located to the left of the Printer/RS-232C connectors on the rear of the 8201A (Figure 3-7). As its name implies, it is reserved for use with an optional bar code reader, not presently available from NEC. Other sources for this "wand" device are: Tandy Corporation (Radio Shack) - Model # 26-1183, B.T.Enterprises - Bohemia, NY (see chapter 11).

Further mention of this device, the software available to operate it and the purposes to which it can be applied appears in chapters 6 and 10 of this book.

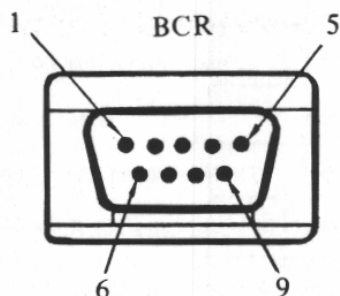


Fig. 3-7 The Bar Code Reader Jack

Pin number	Signal name	Remarks
1	NC	Not connected
2	R x DB	Receive data
3	NC	Not connected
4	NC	Not connected
5	GND	Signal ground
6	NC	Not connected
7	GND	Signal ground
8	NC	Not connected
9	Vcc	+5 V

## Cassette Interface

To the right of the Printer/RS-232C connectors is the 8 pin DIN connector. This connector mates to the cassette cable supplied with your NEC PC-8201A (Figure 3-8). The operation and functions of the cassette recorder are covered in the following chapter.

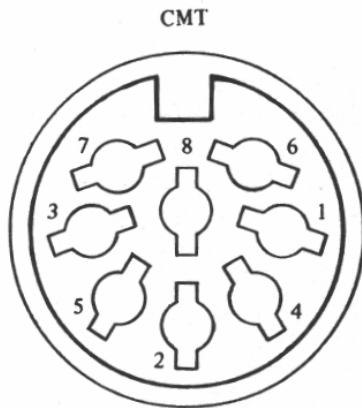


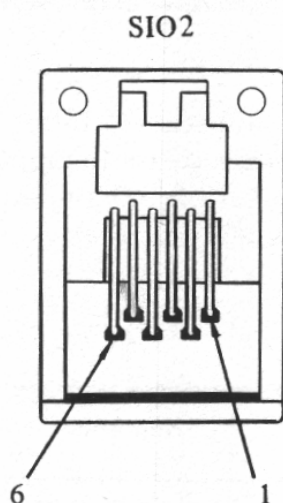
Fig. 3-8 The Cassette Interface

Pin number	Signal name	Remarks
1	T x C	TTL level output
2	GND	Signal ground
3	GND	Electrical power ground
4	MIC	Output to a MIC
5	EAR	Input from EAR
6	REM1	Remote terminal
7	REM2	Remote terminal
8	Vcc	+5 V

## Serial INPUT/OUTPUT 1 and 2

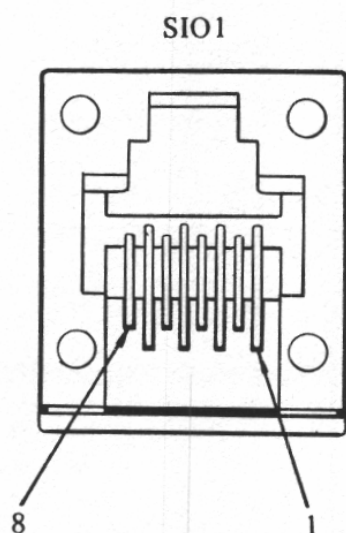
### SIO 2 Connector

A 6 pin Berg modular connector (Figure 3-9) is located to the immediate left of the Bar Code Reader jack. This connector is identical to the ubiquitous phone connectors now in service. Though it would appear to have been designed into the NEC PC-8201A for some communication function, NEC has not yet announced any peripherals that make use of this port. SIO is an abbreviation for Serial Input/Output. Internally, this connector derives signals from the same circuitry that supplies the RS-232C connector. NEC does offer a cable to mate with the SIO 2 port (part number PC-8299A-6).



Pin number	Signal name	Remarks
1	GND	Signal ground
2	TxD	Transmit data
3	RxR	Receive data
4	RTS	Request to receive
5	CTS	Transmission authorized
6	Vcc	+5 V

Fig. 3-9 The SIO2 (Serial Input/Output) Connector



Pin number	Signal name	Remarks
1	GND	Signal ground
2	TxD	Transmit data
3	RxR	Receive data
4	RTS	Request to receive
5	CTS	Transmission authorized
6	Vcc	+5 V
7	NC	Not connected
8	NC	Not connected

Fig. 3-10 The SIO-1 (Serial Input/Output) Connector



### SIO 1 Connector

An 8 pin Berg modular connector (Figure 3-10) is located immediately to the left of the SIO 1 connector at the rear of the machine. A mating cable is available (part number PC-8299A-8). NEC has announced plans for a micro-floppy disk drive that would offer mass storage capabilities beyond what the cassette recorder can provide. This input/output port has been designated as the interface point between this forthcoming peripheral and the NEC PC-8201A. Other adaptations to this port may surface in the future. Like the SIO 1 connector, the SIO 2 derives its signals from the internal serial circuitry and provides another pathway for two-way data transmission.

---

## The System Slot

Located on the left-hand edge of the computer is a spring-loaded door. Pushing the door open with your finger reveals a 48 pin female connector (Figure 3-11). NEC offers a 32K RAM cartridge that plugs in here. This cartridge provides one means of adding more memory capacity to the 8201A. The term "32K RAM" translates to "32 times 1,024 (32,768) units of Random Access Memory". In chapter 6, there is a further discussion of "add-on" memory and the "bank" concept that permits up to 98,304 memory units to be accessed during operation of the machine.

The signals that are present at the SYSTEMS SLOT connector constitute all of the major *bus lines* of the computer. It is quite possible, therefore, that enterprising peripheral manufacturers will soon offer devices that plug in to this access interface. One possibility is a family of program cartridges that will offer a rapid means of introducing software into the computer without the need of either the cassette or micro-floppy disk drive. This is not unlike the "game cartridge" concept that is available on other machines. NEC has announced the PC-8240 Video Interface unit that plugs in here and permits most TV monitors, such as their color Model JC-1460DA, to act as a supplemental display.

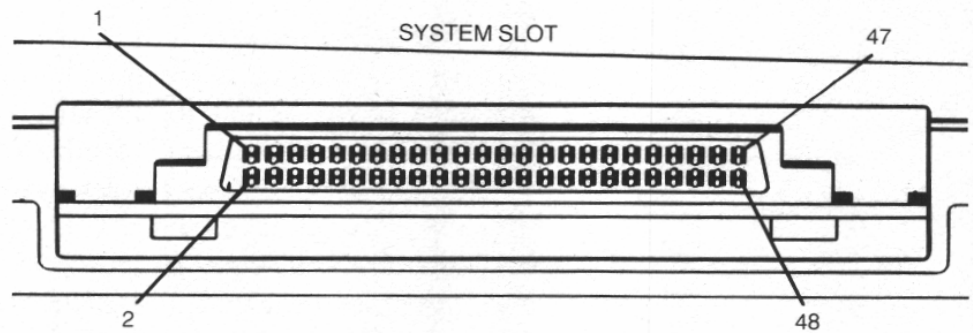


Figure 3-11 The System Slot

Pin number	Signal Name	Remarks
1	VDD	+ 5 V
2	VDD	+ 5 V
3	ADO	Address/Data 0
4	AD4	Address/Data 4
5	AD1	Address/Data 1
6	AD5	Address/Data 5
7	AD2	Address/Data 2
8	AD6	Address/Data 6
9	AD3	Address/Data 3
10	AD7	Address/Data 7
11	NC	No connection
12	NC	No connection
13	A8	Address 8
14	A12	Address 12
15	A9	Address 9
16	A13	Address 13
17	A10	Address 10
18	A14	Address 14
19	A11	Address 11
20	A15	Address 15
21	A16	No connection
22	A18	No connection
23	A17	No connection
24	A19	No connection
25	NC	No connection
26	NC	No connection
27	RD	Read
28	WR	Write
29	IO/M	IO OR Memory
30	ALE	Address Latch Enable
31	HOLD	Hold

(continued)

Pin number	Signal Name	Remarks
32	HOLDA	Hold Acknowledge
33	INTR	Interrupt
34	INTA	Inter Acknowledge
35	RESET	Reset
36	READY	Ready
37	ROME	ROM Enable
38	E	Enable
39	BANK #3	RAM cassette select
40	NC	No connection
41	HABRD	High Address Disable
42	LABRD	Low Address Disable
43	CLK	Clock
44	POWER	RAM Protect Signal
45	GND	Ground
46	GND	Ground
47	NC	No connection
48	NC	No connection

## Summary

In this chapter, we have covered a physical and operational explanation of the various Input/Output connections. It is through these interfaces that the real power of the NEC PC-8201A can be realized. Hopefully this acquaintanceship will aid you in the discussions that follow, as well as suggest ideas for applications beyond what is presently offered.

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# CHAPTER 4 Expanding Storage Capabilities

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## USE OF THE CASSETTE

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The NEC PC-8201A is sold with 16K (16,384 units) of RAM (Random Access Memory) installed. This blank internal memory can be expanded by the addition of more integrated circuit chips (part number PC-8201-06) or by plugging in a 32K RAM cartridge (part number PC-8206A). In total, the machine can be upgraded to hold 96K of user-available memory. Each unit of memory is equivalent to one character of text, thus the word "HELLO" utilizes 5 units (bytes) of machine memory.

While nearly 100,000 memory cells would seem sufficient for all practical purposes, it inevitably falls short at some point in the life of the 8201A. As you accumulate a library of useful programs, you will discover that the machine simply cannot hold them all in storage at the same time. Also, the documents you create, if not purged from memory, will rapidly exhaust the capacity of the computer. While it is possible to plug in and store information on a progression of interchangeable 32K RAM cartridges, this would soon prove to be costly and burdensome. The practical solution to this "memory inventory" problem lies in the use of a cassette recorder.

An external tape recorder provides a means for transferring information in to, and out of, the NEC PC-8201A. Many programs have been written for this computer and are available from "third-party" software publishers on cassettes. A simple means exists for loading your machine with these programs. Similarly, when it becomes necessary to delete files from the computer's internal



memory to make room for other data, the cassette recorder becomes the storage bank that can receive and retain this information. This provision for shuffling information back and forth is essential to the performance of the NEC PC-8201A.

## Cassette Choices

NEC offers a mating Portable Battery-Operated Data Recorder (part number PC-8281A) for use with the NEC PC-8201A (Figure 4-1). In fact, a variety of inexpensive tape recorders on the market will do the job very nicely. One such example is *Radio Shack's model CTR-80A* at half the price of the NEC unit. Ironically, the cheapest recorders work the best since elaborate tone controls tend to distort the data signals that pass between the recorder and the computer. Any recorder you select need only have a microphone input, an earplug output and a volume control. A remote jack (sometimes referred to as an auxillary jack) and a tape counter are valuable features, but they are not essential to the unit's operation for this purpose. It is necessary to use the NEC Cassette Cable (part number PC-8293) that is supplied with the 8201A computer.

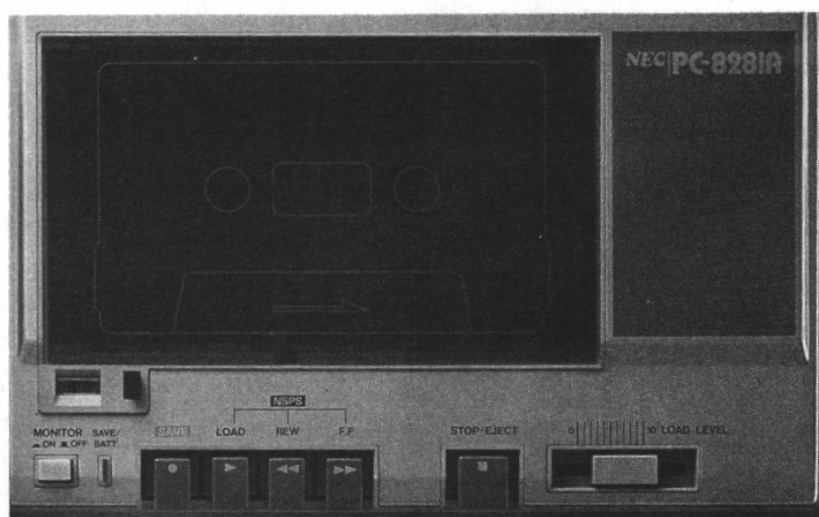


Fig. 4-1 The NEC PC-8281A Portable Battery Operated Data Recorder

## RECORD/ERASE/ PLAYBACK

In operation, the cassette recorder is connected to the NEC PC-8201A by means of the NEC-supplied cable. At one end, it features a round 8 pin DIN plug that mates with the female CMT

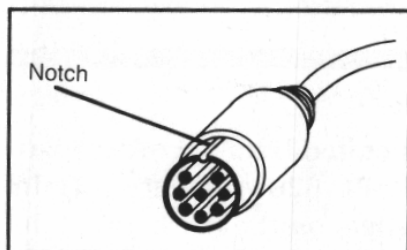


Fig. 4-2 Cassette Cable Polarizing Notch

connector on the back of the computer (see in chapter 3). Make certain that the notch on the end of this connector is pointing upwards (Figure 4-2). The other end of this cable terminates in three separate, miniature plugs which are color-coded red, black and white. The red plug is inserted in the cassette recorder's microphone jack and is the line over which information flows into the recorder. The white plug mates with the cassette recorder's earphone jack and passes information out of the recorder to the computer. Some recorders use the phrase CMT IN or MIC to identify the input and CMT OUT or EAR to label the output. The black plug is used to send a signal to the cassette recorder to start and stop its motor (Figure 4-3). This conveniently permits the computer to remotely control the tape movement. If used, the black plug is connected to the recorder's REMOTE or AUX jack. Not all cassette recorders feature this input. In the absence of this remote control capability, you can manually start and stop the action rather than depending on the 8201A.

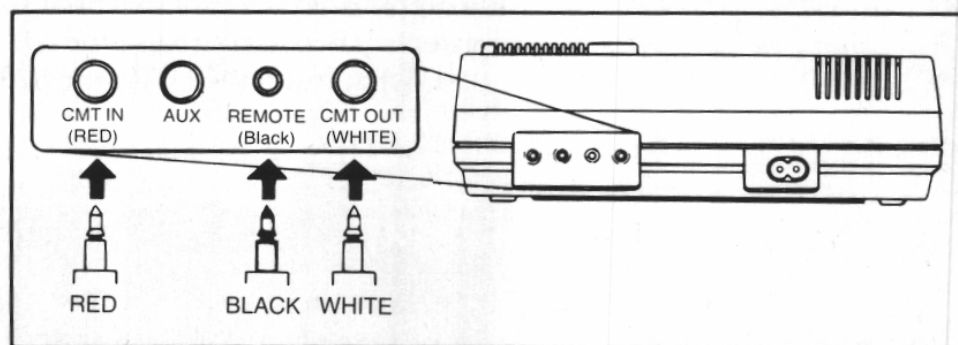


Fig. 4-3 Cable Connections to the PC-8281A Data Recorder

While not overly critical, attention must be paid to the proper volume setting on the cassette recorder. Start by adjusting the control to its approximate mid-range. When a successful **Load** or **Save** has been accomplished, you may not need to move this control again. To best demonstrate the use of the cassette recorder with the NEC PC-8201A, perform the following steps:

1. Connect the supplied cable between the CMT port at the rear of the 8201A and your recorder.
2. Place side A of the NEC-supplied *Personal Application Kit* cassette in the recorder (Figure 4-4).
3. REWIND the tape to the beginning.
4. Turn on the NEC PC-8201A and press the f-1 key. In response to the **Load from** question, type:  
CALC <enter>.



Fig. 4-4 The Personal Application Kit Software Cassette

5. In response to the **Save as** query, type in **CALC.BA** <enter>. Note that it is necessary to append the letters BA, CO or DO at the end of the **Save as** file name. Use BA if you know the file to be a BASIC program. CO refers to a machine language program. Use DO if the file was created as a document file on your TEXT program.
6. In answer to the **Ready?** prompt, type in Y.
7. If you had no means for connecting the REMOTE jack (the black plug) then Press the PLAY key on the recorder. After 10 or more seconds, the display will announce, **Found CALC**. After a short period of time, the display will revert to its normal "Load Save ...etc." appearance, signifying the successful end to the loading of the CALC program.
8. If the black plug was unused then Press the STOP key on the recorder.

You will note the presence of a new file labeled CALC.BA on the display. You have just successfully transferred a BASIC program from the application cassette to the memory of the 8201A. It is there for you to RUN any time you wish. It will not go away even if the machine is turned off. It can only be removed by using the KILL command as described in chapter 1. The CALC program (along with all the other *Personal Application Kit* material) will be described in detail in chapter 10. It can be re-entered in the NEC PC-8201A as many times as you wish. If space is at a premium in your computer (as indicated by the memory capacity figure shown in Figure 4-5 displayed in the lower right-hand corner of the Main Menu), you can

always **Kill** it and **Load** it in only as required. This, of course, is true of any "on cassette" material you acquire.

Let's explore the means for moving information in the other direction. To save a file from the computer out to the cassette recorder, we perform the following steps:

1. Place a good quality, blank cassette tape in the recorder and rewind it to the beginning, if necessary.
2. Advance the tape a short distance. If your recorder is equipped with a counter, zero it and advance the tape to a reading of 10. This is necessary in order to go past the blank leader that most cassettes have at both ends of the tape. No recording can take place on this clear material.
3. Position the cursor of the Main Menu over either a BA or DO file. Only these types of files can be transmitted to the recorder for storage.
4. Press the f-2 key. In response to the "Save <file> name as" prompt, type in any name you wish. It cannot exceed six letters. If it is a DO file, then the next question is **Ready?**. If you do not have a connection to the remote control input of the recorder, then press both the PLAY and RECORD keys simultaneously, and then type a Y.
5. If the file to be "saved" is a BA (BASIC program file), then the next prompt would have been, "B(inary) or A(scii)?". This question relates to the manner in which you might choose to store a BASIC program. If B(inary) is selected, then the file is recorded in a compressed manner with certain coded characters representing the BASIC commands and functions. These characters are referred to as "tokens". Saving in A(scii) takes longer but will produce a readable listing if a printout of the program is needed in the future. For most purposes, the B option is satisfactory. The "Ready?" question will appear next and the procedure is identical to step 4 above.
6. When the display reverts to its normal menu, the "save" has been successfully completed. If you did not use the remote control feature of the cassette recorder, then press the STOP key.

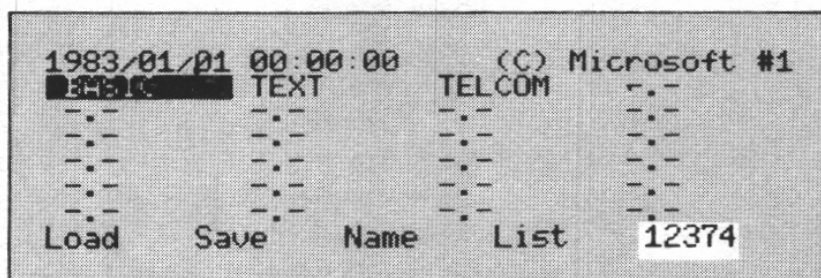


Fig. 4-5 Memory Capacity Indication



It is normal to hear clicking sounds issuing from the NEC PC-8201A as recording or playback take place. These occur as individual "blocks" of data are sent out or brought in. It is desirable to "bulk erase" a cassette tape prior to using it for recording purposes. This will guarantee that there are no spurious signals on it that would be misinterpreted by the computer. DO NOT erase your *Application Kit* cassette! Unless you make a copy of it and all its material, it is the only recording of these useful utility programs you are likely to obtain.

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## Speed and Performance

The transfer of information between the NEC PC-8201A and the cassette recorder takes place at the rate of 55 characters per second. This very slow pace is necessitated by the rate of tape movement in the recorder, and the need to read and record with high reliability. If higher transfer rates were used, the chances of a missed bit of data would increase. While this would only cause a minor stutter in a violin passage, it is catastrophic in a computer system that depends on every element of information to be correct. You might be interested in hearing what this "computer talk" sounds like. Simply pull out the CMT OUT (EAR) plug while doing a **Load**. The chatter coming from your recorder's speaker is what the 8201A listens to. At a speed of 55 characters per second, a program file the size of CALC (2363 characters) takes 44 seconds to load in. While this doesn't compare favorably with the speed and versatility of floppy disk storage, it is acceptable considering its low cost and ease of operation.

It should be noted that, unfortunately, there is no compatibility between cassettes recorded for the 8201A and the *Tandy Model 100* machine. Each company selected a different format of tape recording, and tapes made on one machine will not play on the other. Many worthwhile programs being sold for the Tandy computer are not yet available in a form usable by the NEC PC-8201A. In time, it seems likely that both versions will be distributed in a manner similar to other recorded media. Be certain to mention the 8201A by name when ordering software from advertised suppliers, such as those mentioned in chapter 11.

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## Maintenance

From time to time, it is advisable to clean the recording and playback heads of your cassette recorder. There are any number of prescribed methods for doing that safely and efficiently. Perhaps

the best method is to use a special head-cleaning cassette, sold in most audio supply stores. Instructions in the use of such a device are usually packed along with the special cleaning fluids that work best. Oxide from the tape will build up on the heads over a period of time and reduce (and distort) the output signal. When you cannot achieve satisfactory **Saves** and **Loads** from the computer, then it is time to clean and/or recondition the recorder. The interconnecting cable is much less likely to be a problem, but it is wise to check it for damage should the system become totally inoperative.

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## Summary

This chapter described the means by which data files and program material may be stored and then re-entered into the NEC PC-8201A. Without this capability, the machine would be seriously impaired in its usefulness to you. Fortunately, the cassette interface provides a low-cost, reliable, albeit slow method of information transfer. Other methods of off-line storage are described in chapter 6 but none are as cost-effective as the method described here.

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# CHAPTER 5 Working with the Printer

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## THE COMPANION PRINTER

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Second only to the cassette recorder (or other method of external data storage), a printer is generally the most useful peripheral for any computer. In recognition of that, NEC created a compact, low-cost, portable printer as a companion to the PC-8201A. The PC-8221A device (Figure 5-1) is a parallel interfaced, battery-operated printer that is both size and color coordinated to the NEC PC-8201A. Weighing scarcely a pound with paper and batteries, the 8221A is a suitable, light-weight mate that will handle many printing tasks effortlessly. As should be expected, however, many performance compromises are mandated by the compact design. While battery operation is the key to true portability, the power drain involved makes such operation costly and unpredictable. In recognition of that, NEC has provided for an AC adapter (part number PC-8271A-02) that bypasses the batteries and provides operating current directly from a wall outlet. This philosophy is identical to the 8201A's operating modes and permits them to work together in the field or on your desk. Conveniently, this same AC adapter will operate the PC-8281A Portable Data Recorder as well.

A further compromise is the use of thermal dot-matrix printing as the method of producing hard copy. This printing technique reduces the size and weight of a unit considerably by casting out the conventional printer ribbon and one or two other items. Thermal printing, however, imposes a restriction in that special, and costly, thermally sensitive paper must be used. Maintenance of the device is also somewhat more critical than in conventional inked-ribbon printers primarily because of the "sparking" nature of the printhead when in operation.

All things considered, however, the NEC PC-8221A Printer is a valuable peripheral for the 8201A and retains the "go-anywhere" spirit of this computer.



Fig. 5-1 The NEC PC-8221A Portable Thermal Printer

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## Other Printer Choices

Fortunately, the NEC PC-8201A can be used with a wide variety of available printers. For more serious printing requirements than can be handled by the PC-8221A, you can easily “plug-in” to a host of other machines. A brief description of the two basic styles of printers is appropriate at this point.

### The Daisy Wheel Printer

If serious word processing is your principal goal, then the daisy wheel printer should be your first choice. This family of machines derive their name from the use of a slip-in plastic printing element shaped somewhat like a daisy with many petals. In operation, a letter is formed on paper by the action of a hammer striking the back of a “petal” and pushing it onto an inked ribbon and forcing that onto the paper. The daisy wheel is swiftly rotated (on command from the computer) to bring up the selected character just prior to this operation. As with any electro-mechanical device, there are advantages and disadvantages associated with the design. On the plus side, any daisy wheel printer far outperforms other machines in producing letter-quality output. Also, a wide selection of easily replaceable wheels adds to the versatility of the machine by permitting different font styles to be used to gain various effects.



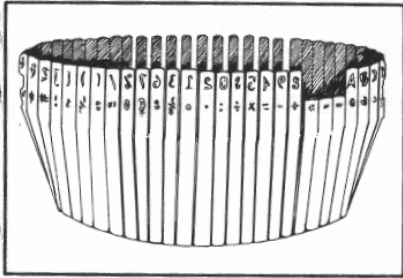


Fig. 5-2 The NEC Spinwriter  
"Thimble" Printing Element

Substituting Gothic characters for Italics is simply a matter of switching daisy wheel elements.

The negatives associated with daisy wheel printers are cost, speed and maintenance. This family of printers, in general, will initially cost two to four times as much as other types of machines you might choose from. They typically contain more parts and are constructed with great precision to tight tolerances. Slow speed is another draw-back to the daisy wheel. While other types of printers will whiz along at 80 to 200 characters per second, the best output obtainable from a daisy wheel is approximately 45 to 55 cps. Most often, 12 to 18 characters per second is all that can be expected from the less expensive machines. Coincidentally, NEC produces what has come to be recognized as the finest such printer on the market, the *Spinwriter*. It is not a true daisy wheel but features instead a thimble-shaped element that might be likened to a daisy whose petals are folded (Figure 5-2).

Maintenance costs are generally higher for a daisy wheel versus others because of the greater likelihood of failure and the higher associated cost of replacement parts. It should be noted, however, that the sturdier (albeit, more expensive) machines, such as the *Spinwriter*, will perform faithfully, without trouble, for long periods.

A new family of daisy wheel printers that are more rightfully called "computerized typewriters" have made their appearance in recent years. They are slow but low-cost, and feature a full keyboard that allows them to double as an office typewriter when not linked to a computer. These double-duty machines are an excellent choice for use in conjunction with the NEC PC-8201A by students or small business organizations. The cost advantage of having an off-line, full-featured electronic typewriter coupled with a computer-driven printer is not to be ignored. One such machine, the *Brother CE-65*, along with its companion IF-50 Computer Interface (Figure 5-3), is an excellent example of this new breed of typewriter/printer.

### The Dot-Matrix Printer

The other principal type of printer available today is the dot-matrix machine. It derives its name from the action that is used to form the characters on paper. The printhead consists of a series of needles that push the inked ribbon against the paper under command of the computer and its own internal electronics. The result is that letters and numbers are formed as a series of closely spaced dots rather than as the action of a single element striking the paper. Because the set of needles are always ready to form successive characters, speed of operation is greatly improved over the daisy wheel. The initial cost of such printers is typically less, as well, and maintenance, consequently, is more reasonable. It is the letter-

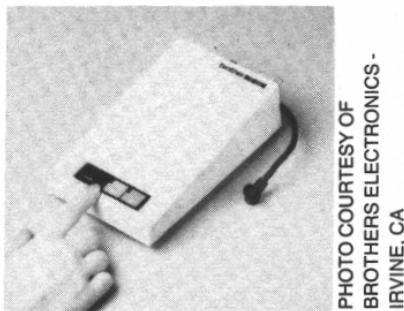


PHOTO COURTESY OF  
BROTHERS ELECTRONICS -  
IRVINE, CA



Fig. 5.3 The Brother EM-65 E  
The Brother IF-50 Typewriter

quality appearance of the finished printing that is sacrificed when selecting a dot-matrix machine. Some newer models overcome this, however, by slowing down their output and printing twice as many dots to fill in the gaps in the formed characters. These "near" letter-quality machines are a suitable compromise if both speed and appearance are a factor.

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## Summary

This chapter has covered the choices available to you in a companion printer for the NEC PC-8201A. The selection will undoubtedly be made based on budget, speed and type of performance required. The student may find the computer interfaceable typewriter to be the most versatile choice, while a journalist could settle for the draft quality of the "two-pass" dot-matrix machine. If the 8201A is to be used principally at home for personal computing, the low-cost, full speed, dot-matrix machines are a wise option. Finally, the user who simply must have a "print-it-anywhere" device will resort to NEC's own PC-8221A. Whatever your choice, be certain that the printer has a Centronics-compatible parallel input. This feature is necessary in order to mate with the 8201A through the special PC-8294A cable offered by NEC. As described in chapter 3, serial input/output operation to a printer is possible, but generally too cumbersome to be used. Then too, such operation "steals" the valuable RS-232C port which is better used for other purposes described in coming chapters.

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# CHAPTER 6 Exploring the Options

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## ACCESSORIES

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Fig. 6-1 The NEC Family of Accessories for the PC-8201A

NEC supplies a complete line of accessories for the 8201A. These include extra memory chips, a thermal printer, modem, cassette recorder, AC adapters, various cables, a 32K RAM cartridge and NICAD battery packs (Figure 6-1). Appendix H lists these items and provides factory specifications where relevant. Available in Japan, but not yet introduced in the United States, is a video/monitor interface and a micro-floppy storage device. While adding significantly to the cost of the system, these peripherals extend the versatility and usefulness of the machine enormously. This chapter examines some of the more valuable, optional equipment, not previously discussed. Though a bar code reader is not offered at this time by NEC, mention is made of this sophisticated accessory as well, and its availability from other sources.

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### Add-On Memory

The NEC PC-8201A is delivered to the user with 16K of random access memory (RAM) installed. In addition, 32K of read-only memory is included in the machine (ROM) and contains the operating system, BASIC and other routines. A provision is made for adding additional RAM or ROM should the user wish to expand the capacity of the computer. At present, no ROM add-ons are available from NEC or others, but most likely will surface as additional functions and peripherals are created. RAM is presently available from NEC and other sources in the form of an 8K by 8 bit module. Sockets are provided under the trap door on the bottom of the machine (Figure 6-2) to hold as many as six of these modules. It is possible, therefore, to increase the random access memory capacity of the 8201A from

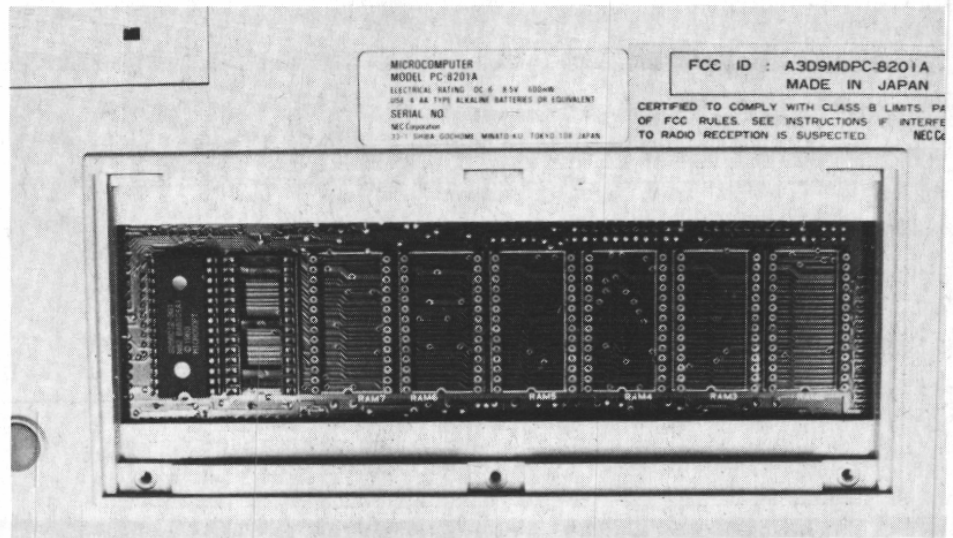


Fig. 6-2 ROM and RAM Sockets Exposed

16K to 64K by filling all of these sockets. The RAM chips are available from NEC as part number PC-8201A-06. Compatible units at lower prices are advertised in various magazines, (see "Accessories" and "Publications" listings, chapter 11). Installation is simple and requires only the screwdriver needed to open the access door. The machine must be "powered down", however, and, as the instructions that come with the chips indicate, you should first SAVE your programs out on tape before such an installation.

The 8201A can only use 32K of RAM at a time. The last 32K you might have installed becomes "bank 2" and can be switched into and out of use as required. Chapter 1 described the bank select function in the discussion of the keyboard. Each bank of memory has its own Main Menu and can hold up to 24 files. Chapter 10 details the supplied software that makes interchange of data between banks possible. Because of this "stone wall" that exists at the end of each 32K of RAM, the usefulness of more memory is questionable. At best, it provides the convenience of keeping additional .DO files or .BA files in the machine for quick recall rather than transfer ring them from cassette. Files may not span across banks, and thus the capability for maintaining very large data files or extra long programs is not improved. If a second bank of memory chips is installed, then a means exists to guard against the accidental loss of data files in this area. The PROTECT switch (Figure 6-3) at the rear of the 8201A is utilized to prevent "writing over" any information that may be contained in bank 2. Naturally, this protect switch should be off if you intend to access any of that bank's files.



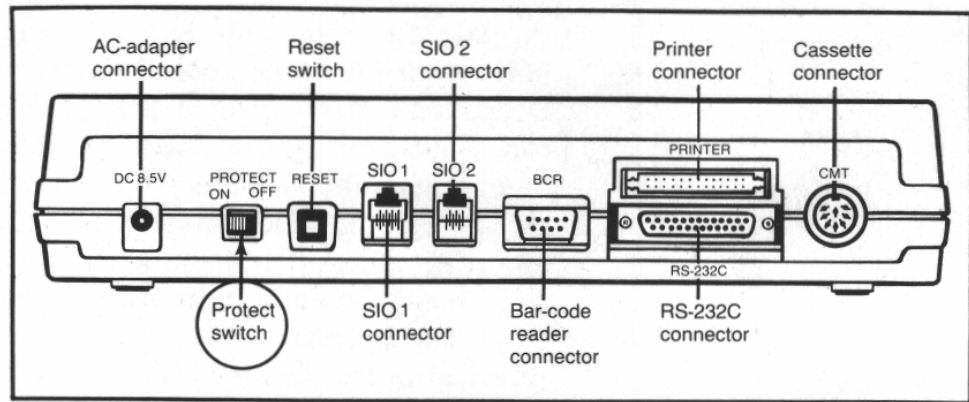


Fig. 6-3 The Bank 2 Memory Protect Switch

## The RAM Cartridge

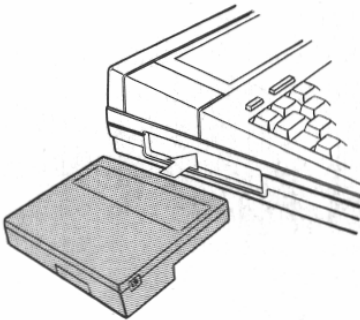


Fig. 6-4 The PC-8206A 32K RAM Cartridge

The system slot behind the spring-loaded door on the left side of the 8201A can play host to an NEC accessory called the 32K RAM cartridge (Figure 6-4). This unit (part number PC-8206A) has a self-contained Lithium battery that supplies up to 6 months of power to preserve its stored information. A *write protect* switch is integrated into the package that offers protection against accidental erasure of data files.

In use, the cartridge is plugged into the left-hand edge of the 8201A and is addressed as "bank 3". The same transfer and switching capabilities that exist between banks 1 and 2 can be employed here as well. The added advantage of the cartridge is its "plug-gability". In seconds, another such cartridge can replace one on which valuable files are stored, and thus provide unlimited capacity in chunks of 32K.

Cost quickly puts a damper on this "memory spree". Each module represents two-thirds of the original price of the machine. Within such constraints, however, the RAM cartridge does provide an additional, interchangeable, on-line data storage method that enhances the overall operation of the NEC PC-8201A. The same AC adapter (part number PC-8271A-01) that supplies power for the 8201A can alternatively be used for the RAM cartridge to carry you through the infrequent battery exchange period.

## The Direct-Connect Modem

As discussed in chapter 3, the RS-232C connector at the rear of the 8201A provides an interface for telecommunications. TELCOM, the resident communication software, will transmit or receive data

through this port. A modem is necessary if transmission is to take place over telephone lines. The function of a modem (MODulator-DEMODulator) is to change digital pulses into tones and decode such tones back into pulses. Dozens of such products are available, including a suitable battery-operated companion to the 8201A sold by NEC (part number Authentic 300 MD — Figure 6-5). Chapter 11 identifies a few other manufacturers.

Most telephone communications take place at a very slow pace. Approximately 27 characters per second are transmitted or received in this fashion. While this 300 words-per-minute rate is considerably faster than the best of typists, it is agonizingly slow for the transmission of very long documents. A four-fold speed up is possible if a more sophisticated and more expensive modem is used. If you are considering using any of the information services (*DOW-JONES*, *The SOURCE*, etc.) on a regular basis, then the investment in a 1200 BAUD modem is worthwhile. These services usually allow contact to be made at either the more common 300 BAUD or 1200. They charge more if you are using the 1200 BAUD service, but since your communications take place four times faster, you net a reasonable savings in service charges.

Proper hook-up to your phone is essential but not complicated. Most cables supplied with modems permit uninterrupted use of the phone for normal purposes, and easy switch-over to data transmission. Some arrangements allow for the use of acoustical cups which fit over the mouthpiece and receiver of your telephone handset. This crude technique is to be avoided, if possible, because of the resultant deterioration of signal quality. Properly installed, it can work, however, and is mandatory when hooking up to public payphones or hotel-room instruments. In general, the majority of equipment sold today works reliably and is compatible with the



Fig. 6-5 The Authentic 300 MD Modem

NEC PC-8201A. Telecommunications between your 8201A and other computers throughout the country is simple to implement and dependable in operation.

## The Bar Code Reader

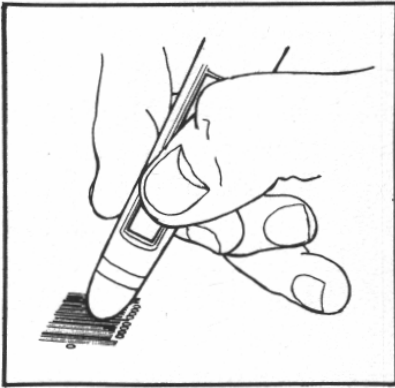


Fig. 6-6 Scanning the Bar Code

Though the NEC PC-8201A has a provision for a bar code reader, NEC does not, at present, manufacture such a device. Others do however, (see listings in chapter 11) and they are compatible with both the 8201A's connector and software routines. Handheld BCR's are often referred to as "wands" because of their pencil-like appearance and handling.

Scanning of bar codes is accomplished by whisking the reader quickly and smoothly over the face of the printed code, as depicted in Figure 6-6.

Many uses exist for bar code reading, such as:

**1.Inventory Control.** You have undoubtedly witnessed the latest in electronic wizardry at your local supermarket check-out stand. A form of bar code reader (usually Laser equipped) is built in to the pass-through counter. The checker deftly passes each can or package of food over the unit. A rewarding "beep" indicates a successful "read" of the printed code that each food product now sports on its label. In fact, the food industry years ago, in a rare display of self-ordained standardization, passed mandatory rulings that require a UPC (Universal Product Code) to appear on all products. The odd-looking lines and spaces (Figure 6-7) are interpreted by the store's computers to indicate a unique food item of a particular size. A computer-maintained list of all items is referenced for the latest price, and the cash register responds to this information. Simultaneously, a perpetual inventory of food stock is updated, and daily reports and purchase orders are issued.

The NEC PC-8201A permits small businesses to accomplish the same kind of control over their inventory by the same methods. A warehouse can be conveniently "scanned" and material counts can be made. The movement of goods in and out of stock can be monitored, and vital and timely reports created. Bar code reading makes this a reality.

**2.Pantry control.** Just as the supermarkets keep track of their stock, so can the homemaker by employing only the 8201A and a BCR. With the proper program running in the machine, it is possible to "read" each food item that comes into the home and those that are used for meal preparation. A computer-generated



Fig. 6-7 Universal Product Code (UPC) examples

shopping list is the result of this tracking action. While a bit more trouble than scribbling a list on the kitchen bulletin board, the accuracy and completeness of the 8201A method may justify the added motions. Food budget analysis, eating habits, calorie counting and other family food statistics are a serendipitous fall-out of this effort.

**3.Computer program transfer.** Perhaps the most useful application for the bar code readers that are compatible with the NEC PC-8201A is for the transfer of BASIC programs into the machine taken from the printed page. NEC demonstrates this capability with their BCR.CO program included on the *Personal Application Kit* cassette. The pioneer work being accomplished by *PCM*, the Portable Computing Magazine, is even more significant. Starting with their April, 1984 issue, they have been publishing useful utility program listings in Code39, one of the universally adopted bar code standard formats. Unfortunately, most of their efforts have been directed to users of the Radio Shack Model 100 computer rather than the 8201A. With modification, the material they are publishing can be made to work successfully with the 8201A, and it is hoped that they will turn their attention to that task soon. Bar code listings of BASIC programs, if carried out by others as well, will undoubtedly prove a boon to NEC PC-8201A users. Rather than having to "key in" a lengthy program or purchase a cassette, it will be possible to "read" a program into the machine from a printed page and thus save considerable time, cost and frustration.

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## Options for the Future

NEC, and others, have plans for additional, novel peripherals and accessories for the 8201A. At a computer convention staged in Los Angeles in early 1984, NEC demonstrated the *PC-8240 Video Interface* unit. This device, presently marketed only in Japan, plugs in to the system slot of the 8201A and transmits a full display (in color) to either a conventional TV or monitor. It is to be presumed that NEC will offer this unit, or an enhanced version, in the United States as well. The possibility exists that this peripheral will also eventually incorporate a micro-floppy disk storage unit. Such a package would allow a user to benefit from the portability of the basic unit, plus "plug-in", at home or office, to a full-sized, expanded system. Radio Shack already offers such a unit as their *Disk/Video Interface (DVI)*, and it is prudent to anticipate a move in the same direction from NEC.



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## Summary

This chapter has introduced you to a number of available (or soon to be available) options that serve to enhance the performance of the NEC PC-8201A. The 8201A should be considered as a powerful central computer unit surrounded by numerous devices that either increase its memory capacity, help it to store information or promote its contact with the outside world. Wisely, the unit was designed to provide for a host of as yet undeveloped accessories. Demand, coupled with technological advances, will dictate what new functions and services the machine will ultimately provide.



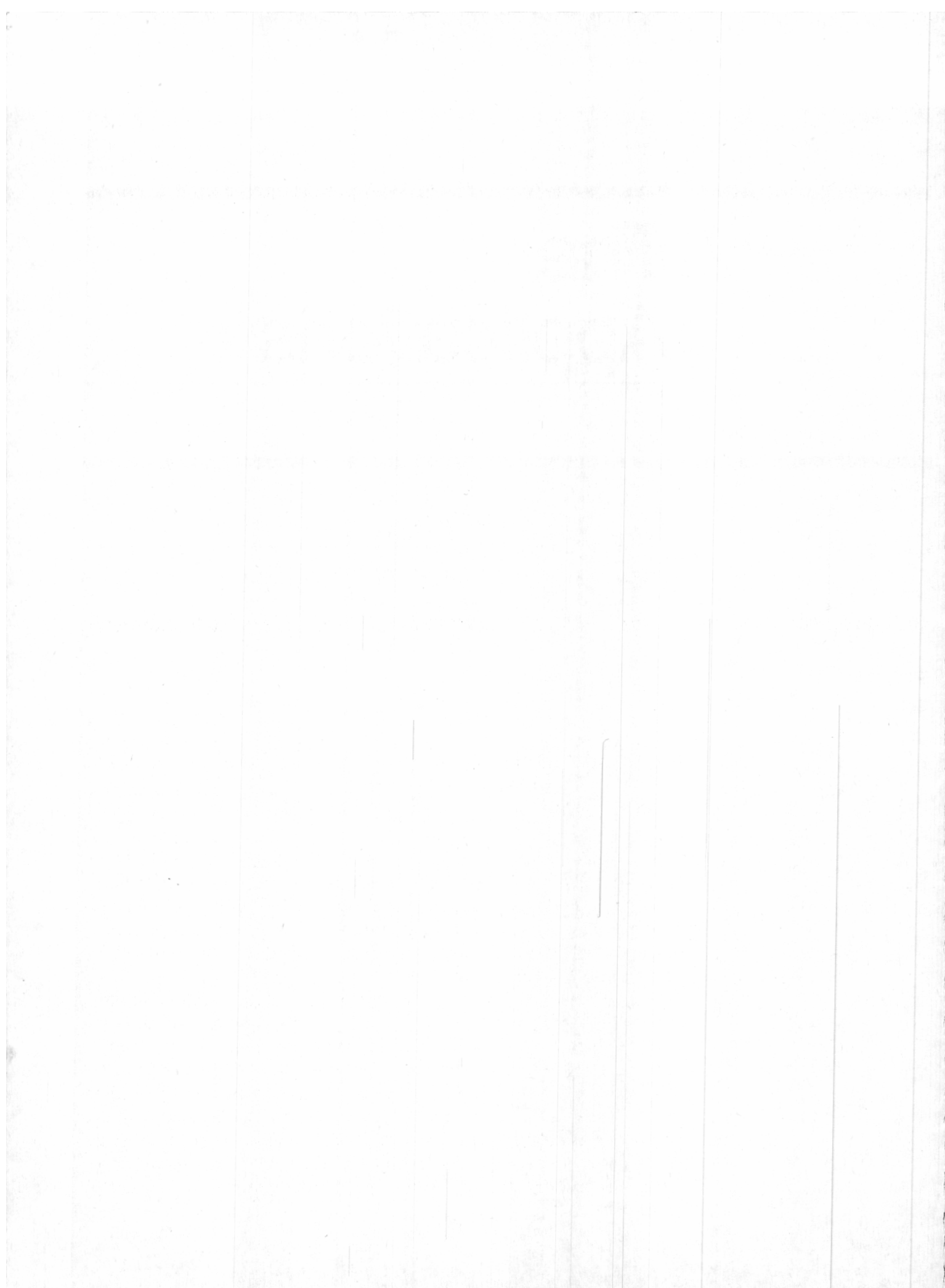
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*PART* **2** The  
Applications

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# CHAPTER 7 Basic: The Resident Programming Language

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## PROGRAMMING THE 8201A

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The NEC PC-8201A differs radically from other computers both in size and performance. It, and a few companion battery-operated machines, represents the product of many technologies combined into one state-of-the-art device. The latest advances in liquid-crystal manufacturing processes have given rise to the large display screen which this computer features. NiCAD (Nickel-CADmium) rechargeable batteries make it work and keep its clock and its memory alive indefinitely. The art of creating LSI (Large Scale Integration) circuits permits an enormous amount of computing power to be packed into a small unit. All of these technologies, plus others, have been brought together to produce this wonder of portable computing capability.

One important thing, however, that the 8201A has in common with all other computers, is the need to be programmed. All computers share this characteristic; that they cannot perform even the simplest task without direction from you, the user. Just as an automobile cannot start itself and go to the drugstore on its own, neither can any computer turn itself on and perform any task without human intervention. The "running" of a computer is accomplished by giving it step-by-step instructions in the form of a program. The term "software" refers to these programs. The machine itself is identified as "hardware".

There are three methods for programming most computers. The first technique is referred to as *machine language programming* and consists of entering information into the machine in the most fundamental form possible. At the heart of every computer is a CPU (Central Processing Unit). This device in the 8201A takes the form of a single integrated circuit chip, the 80C85. It can recognize a few hundred different instructions which it must receive, one by one, from its memory. An example of one such instruction is the one that tells the CPU to move a number from a designated memory location to a register so that a subsequent operation can take place. Machine language programming can be accomplished on the NEC PC-8201A but it is extremely tedious and is certainly not recommended for programs of any significant complexity (Figure 7-1).

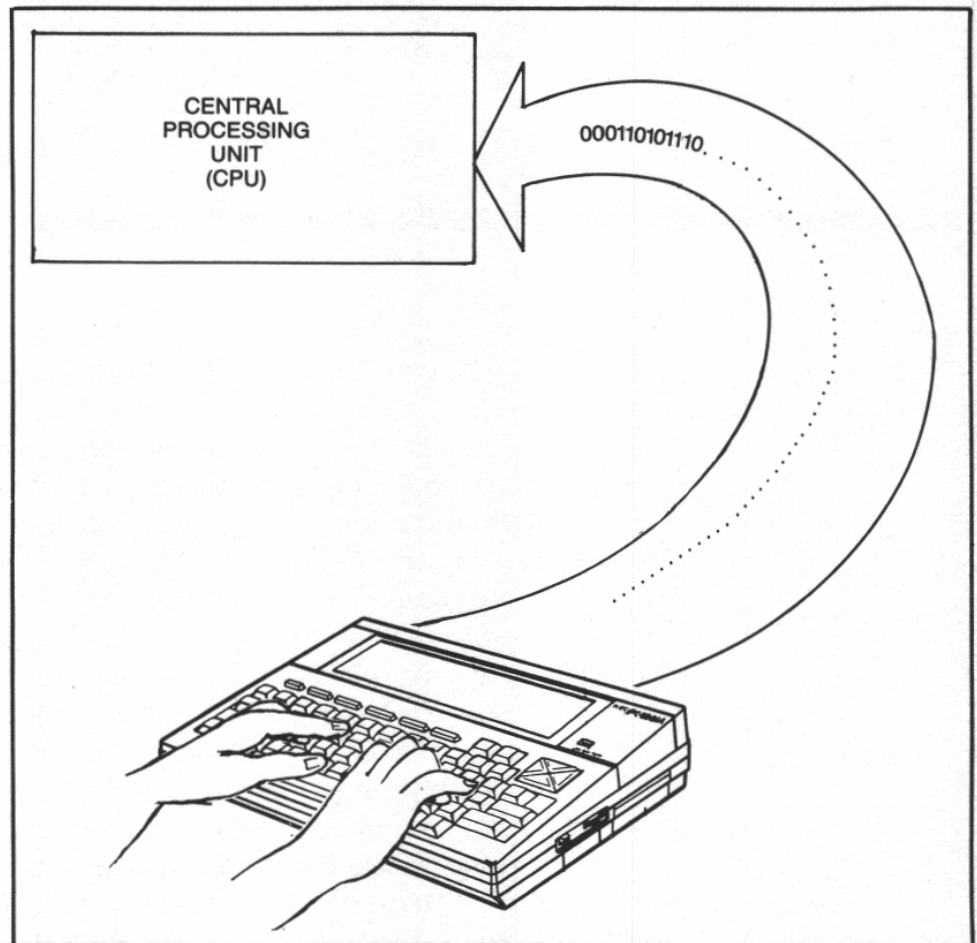


Fig. 7-1 Machine Language Programming

Another method of programming is referred to as *assembly language programming*. The task of creating a useful set of instructions for the computer is eased by making use of an *assembler* program. The assembler acts as a translator of certain mnemonic

(symbolic) codes entered by the programmer (Figure 7-2). Internally, the codes are converted into the same step-by-step instructions that the computer recognizes as machine language. This technique provides a short-hand approach to machine language programming and results in faster, more accurate man-machine communication.

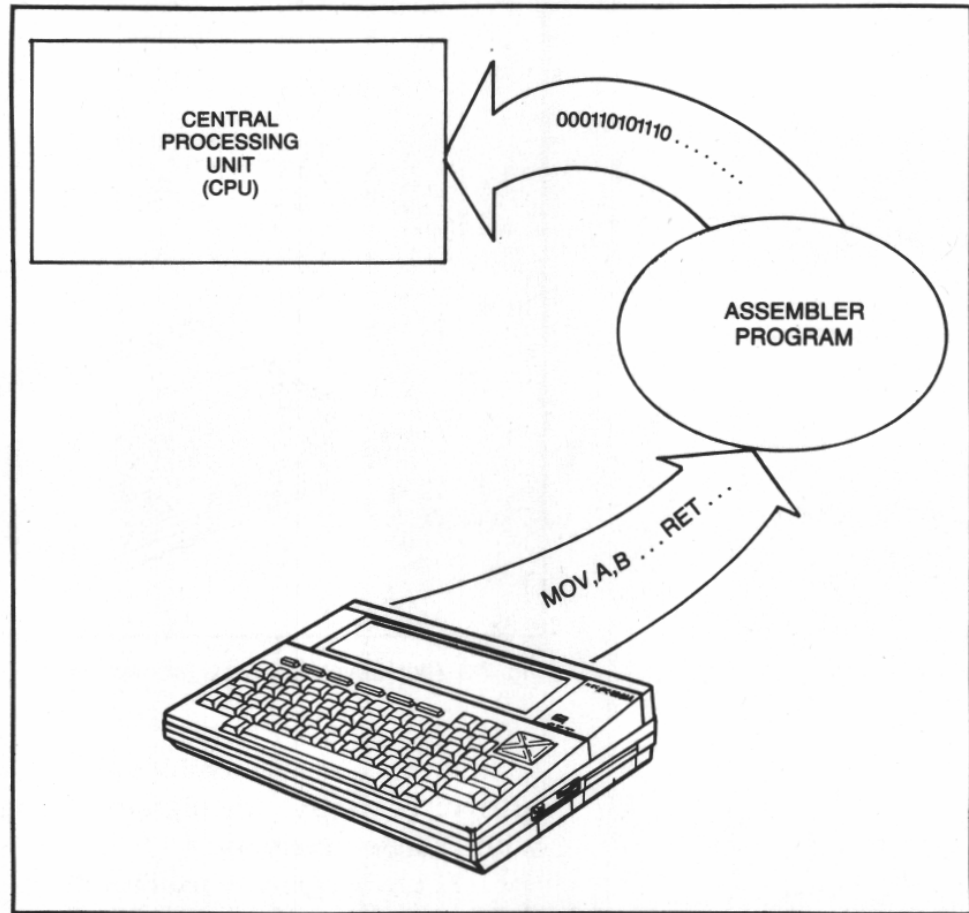


Fig. 7-2 Assembly Language Programming

The third method of programming moves beyond this plateau of effort and makes use of a *high-level language* as the intermediary between the programmer and the computer. FORTRAN, COBOL and BASIC are three of the more popular high-level programming languages in use today. They permit the programmer to write instructions in a crisp, intelligible manner. They are then translated into the fundamental code that the computer understands (Figure 7-3).

While producing the same results for the computer, these three levels of programming become progressively easier for the human. Dozens of separate instructions are necessary to calculate the square root of a number using machine language programming

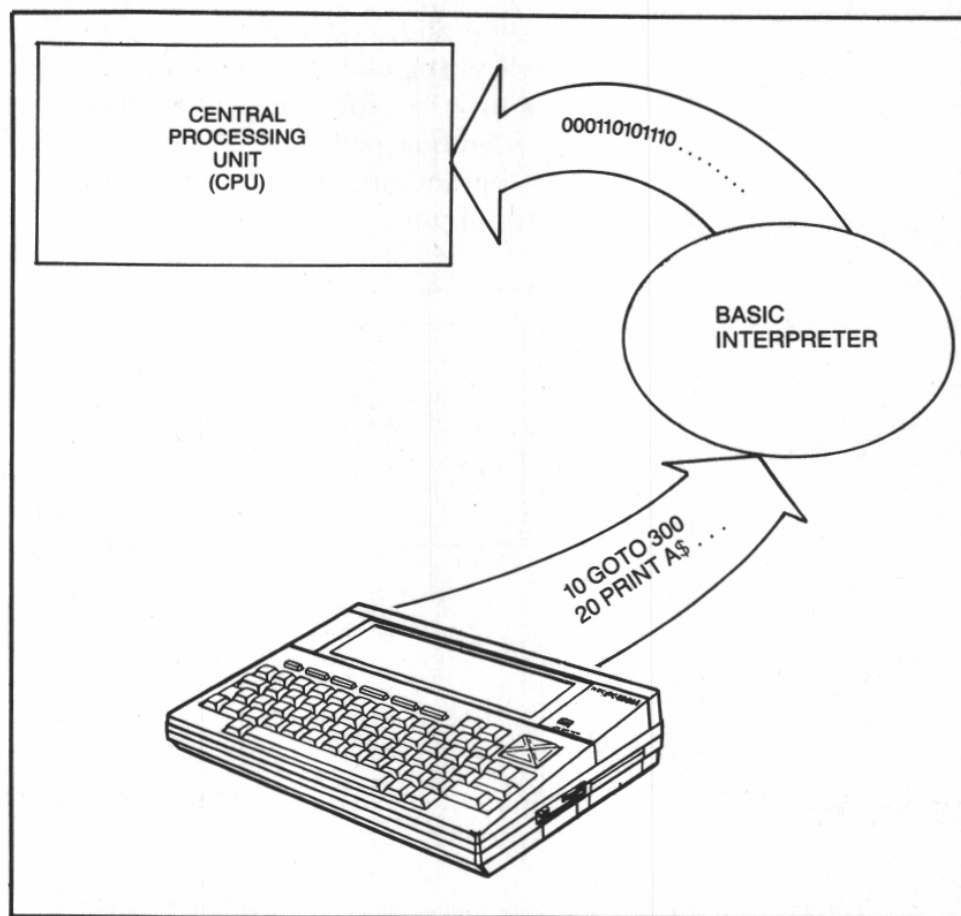


Fig. 7-3 High-Level Language Programming

techniques, but an assembler may reduce the count to perhaps four or five. Typically, any high-level language handles that procedure with a single statement.

There is a penalty paid for the use of a high-level programming language. The language itself must reside in the computer, and it occupies valuable memory space. In addition, the program created by use of the high-level language may be larger than its machine language counterpart. Lastly, the program, more than likely, will execute much more slowly than it would had it been written by either of the other methods. With these considerations in mind, let us explore further the realm of BASIC, the resident high-level programming language of the NEC PC-8201A.

## What is BASIC?

BASIC is an acronym for *Beginner's All-purpose Symbolic Instruction Code*. It was created in the mid 1960's on the Dartmouth University campus as a simplified programming language. Students



were having difficulty in their encounters with FORTRAN; thus BASIC was developed as a more friendly vehicle for the instruction of computer programming. In the years since, BASIC has become the most frequently used programming language, and owes much of its popularity to the proliferation of micro-computers. It is relatively simple to learn and, at the same time, powerful enough to handle complex tasks.

Since 1976, the Microsoft Corporation has been the leader in the field of creating versions of BASIC for each of the emerging micro-computers. It is no surprise that NEC would seek their help in developing a special version for the 8201A. It is identified as N82 BASIC and is similar in many respects to the BASIC in a host of other machines. It is very thoroughly referenced in the N82-BASIC *Reference Manual* supplied with the PC-8201A. This chapter is not intended to serve as a primer for BASIC programming, but rather, to draw your attention to those elements of N82 BASIC that are unique to the 8201A. In this manner, it is hoped that the reader who has previous knowledge of BASIC programming may quickly identify the few dialectal differences that exist in this machine.

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## Functions, Commands and Statements

The language of BASIC consists of a library of words which serve either as *functions*, *commands* or *statements*. A function is used to express a mathematical concept and to carry out a calculation. Addition, subtraction, division and multiplication are all functions and are represented in BASIC by the symbols +, -, / and \* respectively. More complex functions can be found in the language, such as SQR for square root and INT for integer. The list of mathematical functions available in N82 BASIC is considerable and permits even the most complicated formulae to be employed. In addition, the functions that provide for "string" or word manipulation are to be found in this version of BASIC. Not only are LEFT\$, RIGHT\$ and MID\$ available, but also the very useful INKEY\$ and INPUT\$.

A command is a keyword that inaugurates a specific action. In N82 BASIC, as in most versions of Microsoft BASIC, the commands such as RUN, LIST, PRINT and SAVE are used. These are employable in both the direct (from the keyboard) and indirect (within a program) modes. Because of the PC-8201A's reliance on an external cassette recorder for storage, a group of commands specific to that purpose are included. These will be discussed and illustrated later in this chapter along with other unique keywords.

Statements are words or combinations of words in BASIC that create an action or identity within the program. LET X=10 is an example, as is the similarly familiar FOR/NEXT loop. A rich variety

of statements are present in N82 BASIC, a number of which were especially created for the NEC machine.

BASIC programming consists of making use of the proper combination of functions, commands and statements. The greater the lexicon of keywords available to the programmer, the more sophisticated the program that can be created. The NEC PC-8201A utilizes a powerful and unabridged version of BASIC that will allow this "David" of a computer to execute "Goliath" programs.

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## Unique Keywords

N82 BASIC offers more than 100 keywords in its library. Appendix C contains a complete list of these words and their proper format. The majority of these phrases are directly interchangeable with the same keywords to be found in all other BASIC's implemented on hundreds of other kinds of computers manufactured today. Special hardware requirements of the 8201A dictated that some unique words be created that would allow the programmer to adapt his or her task to this machine. Most of these new keywords address themselves to input/output action and permit the display, printer and cassette to be utilized properly from within a running BASIC program. What follows is an alphabetical summary and description of these unique keywords.

### BEEP

BEEP is a command that generates a sound, one-eighth of a second long, from the 8201A's internal speaker. The word is used by itself with no additional parameters. You, as a programmer, might wish to employ it to alert a user to an incorrect keyboard entry. An example of what it sounds like and how it can be invoked is exemplified in the following short routine.

```
100 INPUT "How much is 9 times 8";X
110 IF X<>72 THEN BEEP:GOTO 100
120 PRINT "THAT'S CORRECT!"
```

If this program is entered and RUN it will BEEP and repeat the question until the right answer is given.

### BSAVE/BLOAD/BLOAD?

The first of these three related commands (BSAVE) is used to "save" a machine language program from either the cassette or the

memory of the 8201A, and place it in a designated file. BLOAD is the command which can then invoke the machine language program as required. BLOAD followed by a question mark is employed to verify that a designated machine language program compares exactly to a copy on the cassette. It is useful, at times, to integrate a program in machine language with a BASIC program. A high-speed SORT routine is one such example. Sorting is a task that is called for in many applications. Routines written solely in BASIC are notoriously slow in performing this function. With the capability to invoke a fast machine language utility, your application program can benefit considerably.

#### **CSAVE/CLOAD/CLOAD?**

These three commands are identical to those just described, but are reserved for the saving, verifying and re-loading of BASIC programs rather than machine language programs. As you create a program under BASIC on the 8201A, your entries are being stored in the machine's available RAM (Random Access Memory). If the program is of any value, you will want to preserve it on tape. CSAVE is the command that enables that action. CLOAD brings your program back into memory from tape, and CLOAD? simply verifies that a correct recording has been made.

#### **CLEAR**

The CLEAR statement in N82 BASIC is essentially the same as you would find in all other versions of BASIC. It is worth mentioning here, however, that the special statement, CLEAR256,3200, will regain that memory space lost to the locating of machine language routines in high memory.

#### **COM ON/OFF/STOP**

The COM command is used in BASIC programs that call for the input of information through the RS-232C port during their execution. COM ON tells BASIC that such input will follow, and it allows the program to be interrupted should a transmission be received. COM OFF negates that condition. ON COM GOSUB will divert the BASIC program to a designated subroutine upon receipt of a transmission. COM STOP inhibits that action but leaves it pending until the next COM ON statement is encountered. These commands, combined with OPEN "COM:", are useful for the creation of communication programs in BASIC. Conceivably, one could author a program that lets the NEC PC-8201A dial up another computer, wait for its response and then transmit and receive data from it. While most of those functions are available in the resident TELCOM program (see chapter 9), the auto dial-up feature, unfortunately, is not.

### CSRLIN/POS

These two functions allow the programmer to identify the position of the cursor at any given moment. CSRLIN returns the current vertical position of the cursor and POS returns the horizontal. The top line of the screen is labeled as "0" and the bottom, "7". Similarly, the left-hand edge of the screen is noted as column "0" and the right-hand side is "39" (Figure 7-4). The lower right-hand corner of the display corresponds to CSRLIN 7 and POS 39.

Entering the one-line program, `CLS:PRINT:PRINT CSRLIN,POS(0) <enter>`, will yield the numbers 1 and 14, indicating that that is where the cursor was at the time the program was invoked. POS requires the dummy expression, "(0)" but CSRLIN performs correctly with no additional parameters.

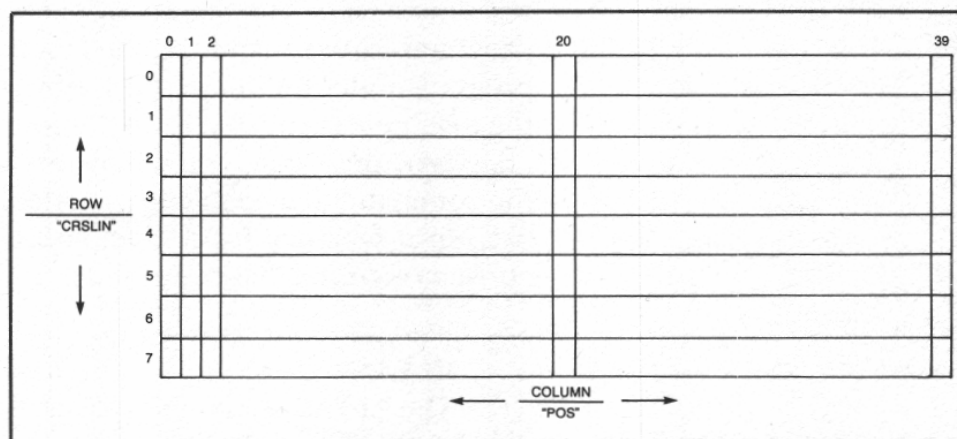


Fig. 7-4 Screen Layout

### DATE\$/TIME\$

These two functions provide the means for both entering and retrieving the current date and time. As we demonstrated in chapter 1, it is always possible to enter a new value for either function. `TIME$ = "hh:mm:ss"` is the proper format for inputting a new time while `DATE$ = "yy/mm/dd"` is correct for date entry. Note that, unlike the familiar way of writing dates, this format requires that the year precede the month and day. The statement, `PRINT DATE$` or `PRINT TIME$`, will retrieve those current values from the 8201A and place them on the display. Benchmark timing between two events is thus made possible from within a program that is being executed.

### EXEC

EXEC is the command that executes a machine language program that has been BLOADED into memory. The one parameter (argument) is the starting address location that was specified at the time of the BSAVE command.



### FILES

Invoking this command from within a BASIC program shows the user the current directory of files. This can be useful in applications where the operator must make a selection for various files stored in the machine.

### KEY

Any of the 10 programmable function keys can be defined by use of the KEY function. Re-assignment is simple and can be invoked from either the keyboard or from within a program. This function provides a convenient method for producing a control statement of up to 15 characters in length with a single keystroke. An example of the correct format for this command is:

```
KEY 7,"CLS:BEEP:MENU"+CHR$(13)<enter>.
```

Pressing SHIFT/f-2 (f-7) will then automatically clear the screen, issue a "beep" and return you to the Main Menu.

### LOCATE

LOCATE is the compliment to the combination of CSRLIN/POS. Although they both yield the current location of the cursor, a LOCATE command places the cursor at the defined spot on the display. Entering LOCATE 20,3:PRINT CHR\$(130) for example, moves the cursor to the middle of the screen and displays a graphic symbol. Proper use of this command adds a professional appearance to any application program.

### MAXFILES

As many as 15 files can be OPENed simultaneously during the operation of a BASIC program. It is necessary to inform BASIC, however, what that number will be so that BASIC can reserve a buffer in memory for each of them. This command establishes the MAXimum number of files that the programmer envisions for that application. In the absence of a specific redesignation, the number of permissible open files is set to one.

### MENU

When the MENU command is entered from the keyboard or when it is encountered within a program, BASIC is exited and the user is returned to the Main Menu. This is commonly employed at the termination of an application program.

**MOTOR**

This command controls the ON/OFF function of the cassette recorder motor. MOTOR 0 turns the unit off and any positive value (up to 255) turns it on. Typical usage would include those application programs that provide for data storage on tape during their execution.

**NOTE:** If you have interrupted a cassette SAVE by pressing the SHIFT/STOP keys, the cassette motor may, under some circumstances, continue to run. It is important that you enter the MOTOR 0 command to reset the 8201A's cassette relay and spare the batteries from excessive drain.

**POWER**

This useful command sets the time delay for unattended "shut-down" of the 8201A. Normally, the computer will turn itself off if no key is pressed within 10 minutes. This period is alterable, or it can be completely negated by invoking the POWER command properly. POWER CONT implies continuous power, while POWER 400 extends the delay to 40 minutes. POWER OFF causes an immediate shut-down of the 8201A. Start-up is then only possible by flicking the ON/OFF switch.

**PSET/PRESET**

This pair of complimentary statements direct any spot (pixel) on the display to be turned ON or OFF. PSET (PixelSET) activates a location and PRESET (PixelRESET) resets it. Typing in:

```
CLS:FOR Z=1 TO 4:FOR X=20 TO 220:PSET(X,30):NEXT:
FOR X=220 TO 20 STEP-1:PRESET(X,30):NEXT:NEXT <enter>
```

demonstrates this "dot/on-dot/off" capability. Use of this graphic technique can enhance an otherwise bland program.

**SCREEN**

The SCREEN statement provides a means for canceling the function key display at the bottom line of the screen. SCREEN 0,0 blanks it out, leaving the eighth line available for other use. SCREEN 0,1 reinstates it. Most professional BASIC programs for the 8201A will begin and end with this pair of statements.

**SOUND**

The SOUND command triggers a tone burst from the 8201A's internal tone generator. The device is not a conventional loud-speaker, but rather a compact, low-power, piezo-electric trans-

ducer. The term SOUND is followed by two parameters. The first value designates the tone and ranges, from a low note of 0 to the highest pitch obtainable at 16383. The second value sets the duration of the note through a range of 0 to 250. Each unit equals two-hundredths of a second. Thus the command SOUND 5586,50 will produce a one second tone of middle A on the musical scale. Figure 7-5 provides a reference table of the musical scale codes. Just as PSET and PRESET can enhance a program with their graphic cavorting, so too can SOUND be employed to add another dimension (Figure 7-5).

MUSICAL SCALE TABLE:

		OCTAVE					
C O D E		1	2	3	4	5	6
	C	-	9394	4697	2348	1171	587
	C#	-	8866	4433	2216	1103	554
	D	-	8368	4184	2092	1045	523
	D#	15800	7900	3950	1975	987	493
	E	14912	7456	3728	1864	932	466
	F	14064	7032	3516	1758	879	439
	F#	13284	6642	3321	1660	830	415
	G	12538	6269	3134	1567	783	-
	G#	11836	5918	2954	1479	733	-
	A	11172	5586	2793	1396	693	-
	A#	10544	5272	2636	1316	653	-
	B	9952	4968	2486	1244	622	-

Fig. 7-5 The SOUND command's musical scale range

## Summary

This chapter provided an overview of the Microsoft BASIC language which is resident within the NEC-PC 8201A. All the machine instructions for BASIC are contained within the 32K ROM (Read Only Memory) device located behind the screwed-down door on the bottom of the unit. The provision for an additional 32K ROM chip may offer future enhancements to BASIC, such as color and floppy-disk operation. Even without such embellishments, however, N82 BASIC provides the programmer with a sophisticated, high-level language which has extensive application capabilities.

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# *CHAPTER* 8 Text: The Word Processor

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## LETTER PERFECT OPPORTUNITIES

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Perhaps the most popular usage for micro-computers today is word processing. Word processing is defined as the "computerized creation and editing of text". Whether it be a student's notes, a multi-paged piece of correspondence or an entire manuscript, computers have proven their value as text preparation devices. The ability to view and correct a document before printing it is but one of the benefits of word processing. The facility to re-arrange sentences, paragraphs or whole blocks of text in an instant is another typical feature of most word-processing programs. Some of the more powerful versions on the market offer both grammar and spelling checking as well as automatic hyphenation. The capability to globally "search and replace" a word or phrase automatically is yet another example of the remarkable power that many of these programs offer.

The list of features and benefits of word processing is long and valuable. Law firms, years ago, discovered the cost savings that can be achieved by preparing briefs and contracts on the computer. The reduction in re-typing time alone frequently repaid the cost of the equipment in short order. Most modern newspapers have become dependent on computers to process the mountain of text that is created daily. No other technique available today compares to the efficiency offered by these machines.

With the advent of the microcomputer and, perhaps more importantly, the battery-operated versions such as the NEC PC-8201A, word processing will soon have many more devotees. Students, business-persons, salespeople and others, with no previous access to large computers, now can make use of this innovative method of electronic letter-writing. The 8201A, with its built-



in TEXT program, is an excellent choice to satisfy this need. While limited in its capabilities, compared to larger computers, it offers most of the valuable features needed to efficiently create and modify documents.

---

## Working with Text

### The TEXT Mode

The Main Menu always displays the three resident programs of the 8201A. The cursor (dark outline) appears over the first of these, BASIC, whenever the machine is turned on. Pressing either the space bar or the right arrow of the cursor cluster moves the cursor over the word TEXT. Pressing the <enter> key is all that is required in order to select the TEXT mode. You are then presented with the prompt, "File to edit?". Up to six characters can be used to name a new file. Either upper or lower-case letters may be used, and each such version is recognized as a different filename. If you have named a new file, TEXT knows you are composing a fresh document and presents you next with an arrow prompt in the upper left-hand corner. You are now ready to start entering your text.

### Entering Text

Entry is identical in many ways to operating a typewriter. The SHIFT keys produce upper-case letters and the CAPS key alternately switches you between upper and lowercase. The BS (backspace) key will correct your mistakes by backing up and erasing one character at a time. The cursor cluster arrow keys (upper right-hand group of keys) will move you forward and backward on the line, as well as upward into previous text. These movements are nondestructive in that none of the characters in the cursor's path are erased. If text is to be added in the middle of existing words, then it is only necessary to move the cursor to that point and start typing. All the subsequent text will shift to the right making way for the new material. Unlike a typewriter, it is not necessary to press the <enter> key at the end of each line. TEXT will "wrap around" to the next line and carry any incomplete words with it. If you hyphenate, it will leave the partial words just as you entered them. The <enter> key is used to signal the end of a paragraph and moves the cursor to the next line. The TAB key will indent your text eight spaces. If you wish to make deletions in the middle of the text, pressing either of the SHIFT keys and the DEL key simultaneously will accomplish that.

### Special Functions

The CTRL (control) key and the SHIFT keys, used in combination with the arrow keys, perform special functions. These are:

CTRL and ↑ moves the cursor to the beginning of the document.

CTRL and ↓ moves the cursor to the end of the document.

CTRL and → moves the cursor to the right end of the line.

CTRL and ← moves the cursor to the left end of the line.

SHIFT and ↑ moves the cursor to top line of the screen. If it is at the top, then it will present the previous "page".

SHIFT and ↓ moves the cursor to the bottom line of the screen. If it is at the bottom, then it will present the next "page".

SHIFT and → moves the cursor one word to the right.

SHIFT and ← moves the cursor one word to the left.

### The Function Keys

The five function keys at the top of the keyboard perform special tasks when used with TEXT. Taken in order, the operations they invoke are:

**f-1 Find.** Pressing the f-1 key places you in the "search" mode. The prompt "String:" will appear which is answered by entering any string of up to 24 characters. When the <enter> key is then pressed, the text is searched from the cursor's present location forward to the end of the document for the first occurrence of that string. If none is found, the message "No match" will appear. Unless you know approximately where the string you are seeking is located, it is best to move the cursor to the beginning of the document (CTRL and ↑) and start your search from there. If a match is found, the blinking cursor will jump to the first character of the specified string. A match will be made regardless of whether upper or lowercase was specified. Repeated pressing of the f-1 key and the <enter> key will move you to following occurrences of the same string. The previously designated string is retained and displayed each time you press the f-1 key, but typing in a new string will cause it to be replaced.

**f-2 Next.** The f-2 key is used in combination with the “find” function of the f-1 key. After using f-1 to search out the first occurrence of a designated string, pressing the f-2 key will move the cursor to the next matching location in text. It is a useful short-cut that replaces the two strokes, f-1 and <enter>. As with f-1, when no further matches of the string can be found, the message “No match” appears. Pressing the STOP key ends the search and returns you to the text-entering mode.

**f-3 Sel.** The f-3 key allows you to “select” a portion of your text to be moved into a temporary work area called the *Paste Buffer*. Its use is simple. If you have a section of your document that you wish to either erase or replicate, you *mark* the start of the section by pressing the f-3 key. As you then advance the cursor to the end of the designated block, you will note that all the text in between changes into clear characters on a black background. This denotes the section to be placed in the Paste Buffer. The f-3 function (Select) doesn’t actually alter anything. It is used solely to bracket a portion of text to be worked on by either of the next two functions, “Cut” or “Copy”. It can be negated at any time by pressing the STOP key. The block to be cut or copied can be as little as one letter or as large as the entire document. After locating the cursor in the text block and pressing f-3, you can move forward or backward as you wish. The inverse video presentation shows you the precise text being drawn in to the Paste Buffer.

**f-4 Cut.** After a section of the document has been highlighted by using the f-3 (Select) function, you then have the option of either removing that block entirely or duplicating it elsewhere. If deletion is what you intend to do, then it is only necessary to press the f-4 key after your block selection is completed. The text will vanish from the display. If you wish to *move* the text from its previous location to a different one, then you first must “Cut” it and then “Paste” it back in at the new spot. Remember that the “Select” function permits you to designate text that will be duplicated in the Paste Buffer. There it will remain until a new selection of text replaces it. Even after “cutting” it, therefore, it still resides in the buffer but not on the display. The “Paste” function (SHIFT/PAST) will bring all the text in the buffer up to the screen, starting at the present cursor location. Since the buffer is not emptied by this process, you can replicate the text as many times as you wish at as many locations as is desired. This feature is useful for reducing text preparation time by allowing you to put an often-used phrase in the buffer and then pulling it up to your document as needed.

**f-5 Copy.** The “copy” command (f-5) performs exactly the same function as the “cut” command except that it doesn’t erase the

designated text. After selecting the block of text with the f-3 function, using the copy command duplicates it in the Paste Buffer, but it still remains in its original location. You can then introduce a copy of the text anywhere in your document by moving the cursor to the desired location and pressing the SHIFT/PAST keys.

**f-6 Keys.** While in the TEXT mode, the last line of the display is clear of the usual function key definitions. If you wish to have them shown to you as a reminder of what each "f" key does, then press f-6 (SHIFT/f-1). Alternate toggling of this key will present the definitions or remove them. The f-7, f-8 and f-9 keys serve no purpose in TEXT.

**f-10 Menu.** Leaving the TEXT mode and returning to the Main Menu is accomplished by pressing the SHIFT/f-5 (f-10) combination. The DO file you were working on is saved and named on the menu. Should you wish to return to it for further processing, you need not enter TEXT but can go directly to the file by selecting its name with the moving cursor block and pressing <enter>. Turning off the machine without exiting TEXT still preserves your work. It is advisable to make a cassette copy of your document as a precaution against accidents. This simple procedure takes but a few minutes and can spare you the frustration of losing valuable work. Refer to chapter 4 for the steps necessary to save a DO file on tape.

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## Printing Documents

After a document has been created using TEXT, it may be recorded on tape, transmitted to another computer or typed out onto any available printer. Making a cassette recording has been described previously (chapter 4). An archive of your major documents on tape can provide a useful library to draw from. As occasion dictates, it is possible to load an old document into the 8201A and re-edit it into a new and useful letter or manuscript. It is strongly urged that you develop the habit of recording any significant text in this fashion, properly labeling it and storing it safely.

Transmitting a TEXT document to another computer will be discussed fully in the next chapter which deals with TELCOM, the resident telecommunications software. The technique of passing text from the NEC PC-8201A to other word-processing machines can be very useful. Portions of a larger manuscript can be conveniently created on the 8201A most anywhere, and then merged into a master document on a computer across the room or across the continent. The portability of the 8201A provides a means for cre-



ative writing on a plane, in a hotel room or on the patio. Memos can be written at your convenience and later transcribed electronically at the office. The combination of TEXT and TELCOM provide an extraordinarily versatile word-processing capability that is the feature strength of the NEC PC-8201A.

The means provided for printing out a DO file is discussed in chapter 1 in the section devoted to the LIST command. While use of this function will, indeed, provide a hardcopy of your document from your printer, the formatting capabilities are limited. For example, you may have created a two-page letter and now want a copy for yourself as well as the party it is addressed to. The LIST function has no provision for pausing between pages. If you are printing on your company letterhead, this presents a problem. Neither will LIST permit centering the printing on the paper or conveniently making additional copies. LIST also automatically types the name of the DO file on the first line. This undesirable action cannot be inhibited, and you must resort to "whiting out" the offending line from your correspondence. Fortunately, a number of software publishers have created various text formatting programs for the NEC PC-8201A. They are identified and discussed in chapter 11 along with other software available for the machine. A clever program, written in BASIC, that provides a number of missing features is included here for your use. The program was created by David Ahl, founder and editor-in-chief of *Creative Computing Magazine*. To use it you must enter BASIC, type it in exactly as it is listed here and Save it as a BASIC file. You can give it any name you wish, but FORMAT.BA is most suitable.

```

100 SCREEN 0,0:CLS:PRINT "FORMAT program for text output."
110 PRINT "by David H. Ahl for the NEC PC-8201.":PRINT
    "FILES ON COMPUTER:"
120 DEFINT C,D,E,J,L,M,P,Z
130 PG=0:Z=66:L=70:TB$=CHR$(9):CR$=CHR$(10):FILES
140 INPUT "FILE NAME (MUST BE .DO FILE)";N$:OPEN N$ FOR
    INPUT AS 1
150 INPUT "PAGE LENGTH (NORM = 66 LINES)";Z:Z=Z-1:PL=Z-9
160 INPUT "MAXIMUM LINE LENGTH (NORM = 70)";L:LT=L:E=L
170 INPUT "LEFT MARGIN";M
180 IF M>=L THEN PRINT "TOO HIGH. AGAIN":GOTO 170

```

(continued)

```

190 INPUT "HALT AT PAGE END (Y or N) (NORM = N)";H$
195 INPUT"HOW MANY COPIES";CC
200 INPUT "LINE SPACING (1,2 or 3)";D
210 IF D<1 OR D>3 THEN PRINT "CAN'T DO. AGAIN...":GOTO 200
220 INPUT "PAGE TITLE AND NUMBERING (Y or N)";P$
230 IF P$="n" OR P$="N" THEN 260
240 INPUT "PAGE TITLE";T$
250 IF LEN(T$)>L-8 THEN PRINT "TOO LONG. AGAIN...":GOTO 240
260 IF H$<>"Y" AND H$<>"y" THEN 290
270 PRINT "HIT RETURN WHEN PRINTER IS READY"
280 B$=INKEY$:IF B$="" THEN 280
290 IF P$="n" OR P$="N" THEN LC=0:GOTO 340
300 PG=PG+1:LPRINT
      TAB(M);T$;TAB(M+L-7);"PAGE";PG:LPRINT:LC=2
310 ON D GOTO 340,330,320
320 LPRINT:LC=LC+1
330 LPRINT:LC=LC+1
340 FOR C=1 TO LT
350 IN$=INPUT$(1,1):IF EOF(1) THEN 510
360 IF IN$<>TB$ THEN 380
365 REM The next line requires 8 spaces between the
      quotation (") marks.
370 PR$=PR$+"          ":C=C+7:GOTO 390
380 PR$=PR$+IN$:IF IN$=CR$ THEN E=L:GOTO 440
390 NEXT
400 FOR E=L TO 1 STEP-1
405 REM The next line requires 1 space between the quotation
      (") marks.
410 IF MID$(PR$,E,1)=" "OR MID$(PR$,E,1)="-"THEN 430
420 NEXT:E=L
430 PT$=RIGHT$(PR$,L-E):PR$=LEFT$(PR$,E):GOTO 450

```

(continued)

```

435 REM The next line must have no space between the
      quotation (") marks.
440 PR$=LEFT$(PR$,LEN(PR$)-2):PT$=" "
450 LPRINT TAB(M);PR$:LC=LC+1
460 ON D GOTO 490,480,470
470 LPRINT:LC=LC+1
480 LPRINT:LC=LC+1
490 PR$=PT$:LT=E
500 IF LC=>PL THEN 520 ELSE 340
510 LPRINT TAB(M);PR$:LC=LC+1
520 IF Z=9998 THEN 540
530 FOR J=LC TO Z:LPRINT:NEXT
540 IF EOF(1) THEN 550 ELSE 260
545 CN=CN+1:IF CN<>CC THEN 260
550 PRINT "PRINTING FINISHED":SCREEN 0,1:END

```

When the program is RUN, it first displays all the files presently stored on your computer. This enables you to see the proper names of the various documents you have created. You are then asked to enter the name of the DO file you wish to have printed out. Be sure to match the chosen file name exactly, although the .DO appendage need not be typed. Next you are asked to enter the number of lines on the paper you are using. Eleven-inch-long paper is most common and, at six lines to the inch, it is 66 lines long. If you just press the <enter> key, the value of 66 will automatically be used by default. Other numbers can be calculated by you and used for shorter or longer paper. The next query has to do with how many characters you want on each line. If you are using 8 1/2 inch-wide paper and printing at the conventional 10 characters per inch, there is room for a maximum of 85 characters on each line. 70 is a more appropriate figure and is the default value in this program. After this reply, you are asked for a number representing a left margin indent, if desired. The printing will be "tabbed" by this amount. This lets you locate the printing as desired. Pressing the <enter> key without typing in a value produces no left margin indentation. The next question, if answered with a "Y", will pause the printing so that you can change paper before going on to successive pages. The default is "N" and is used if you are printing on continuous forms. You next have the option of requesting more

than one copy of your document. Single, double or triple spacing can be selected by properly answering the next question to appear on your screen. Next you are asked if you want each printed page to be titled and numbered. If you reply "Y", you are requested to enter the titling information. Finally, printing will begin. If you indicated that you want to pause between pages, you will be requested to press the <enter> key before printing can start. Otherwise, printing is automatic and will continue until all the copies you requested are completed. Pressing the STOP key at any time will halt the printing and interrupt the program.

We found this formatting program to be most useful and are pleased to include it here. It overcomes most of the serious limitations of the simplistic LIST command. We wrote a companion program to it that prints the name and address portion of a letter on envelopes. It works like this; if the document you created is a piece of correspondence, and if it contains the mailing address within the first six lines, then this program will lift that information from the head of the letter and type it directly onto your envelopes. It's simple, but effective.

```

100 SCREEN 0,0:CLS:PRINT "ENVELOPE print program"
110 PRINT "by Marvin Mallon for the NEC PC-8201A.":PRINT
    "FILES ON COMPUTER:"
120 DEFINT A-Z
130 CR$=CHR$(10):TB$=CHR$(9):FILES
140 INPUT "FILE NAME (MUST BE .DO FILE)";N$:OPEN N$ FOR
    INPUT AS 1
150 PRINT "HIT ENTER WHEN PRINTER IS READY."
160 B$=INKEY$:IF B$="" THEN 160
162 FOR X=1 TO 6
165 FOR C=1 TO 77
170 IN$=INPUT$(1,1):IF EOF(1) THEN 550
180 IF IN$<>TB$ THEN 210
190 PR$=PR$+STRING$(8,32):C=C+7:GOTO 220
210 PR$=PR$+IN$:IF IN$=CR$ THEN E=77:GOTO 300
220 NEXT
300 LPRINT TAB(30)LEFT$(PR$,LEN(PR$)-2)

```

(continued)



```
310 PR$=" "  
400 NEXT X  
  
550 PRINT"PRINTING FINISHED":SCREEN 0,1:END
```

As with the FORMAT.BA program listed previously, enter BASIC and type in each of the lines above exactly as shown. Then type SAVE"ENVLOP.BA" <enter> and the program will be available whenever you need it. When it is RUN, it also shows you the names of all the DO files first. After your selection, no other questions are asked. You signal that you have placed an envelope in your printer by pressing the <enter> key. The first six lines of your DO file are then typed out and the program ends.

---

## Summary

In this chapter we have explored the TEXT mode that resides in every NEC PC-8201A. The commands and functions of this program have been described, and an overview of word processing was presented. In addition, two helpful programs that supplement TEXT were listed for your use. Later, in chapter 11, we will identify other available software that either augments or replaces TEXT. TEXT, the word processor of the 8201A, is a handy program, easy to master and work with. If the 8201A offered no other features, TEXT alone would justify its cost.

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## CHAPTER 9

# TELCOM: Telecommunications Software

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## THE INFORMATION LINK

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The earliest computers were stand-alone machines that performed the tasks they were programmed to do and could communicate the results only to a printer. Later, various displays were added so the operators could witness the results of the activity and verify their entries. As computers proliferated, it was essential that they also have a means for transferring information from one computer to another. Small computers needed to be linked with large mainframes in a corporate environment. Government machines had to dispatch large amounts of data to remote computers throughout the country. In addition, the need for world-wide communications became evident.

In one of the rare instances of standardization in the electronics industry, the RS-232C communication protocol was created. It describes both the hardware and software configuration that computers might have in order to effect the reliable transmission of data between them. These guide lines could be adopted by any computer manufacturer if they wished their machine to have the capability to access others.

In addition to the electronics housed within the computer itself, a device had to be developed that permitted ordinary phone lines to serve as the communication link. This device took the form of a Modulator/Demodulator (MODEM). A modem translates electronic impulses into specifically coded audio tones, capable of passing both ways on any telephone circuit (Figure 9-1). In practice, tens of thousands of computers use this technique to transfer information back and forth daily. Brokers access the Stock Exchange com-

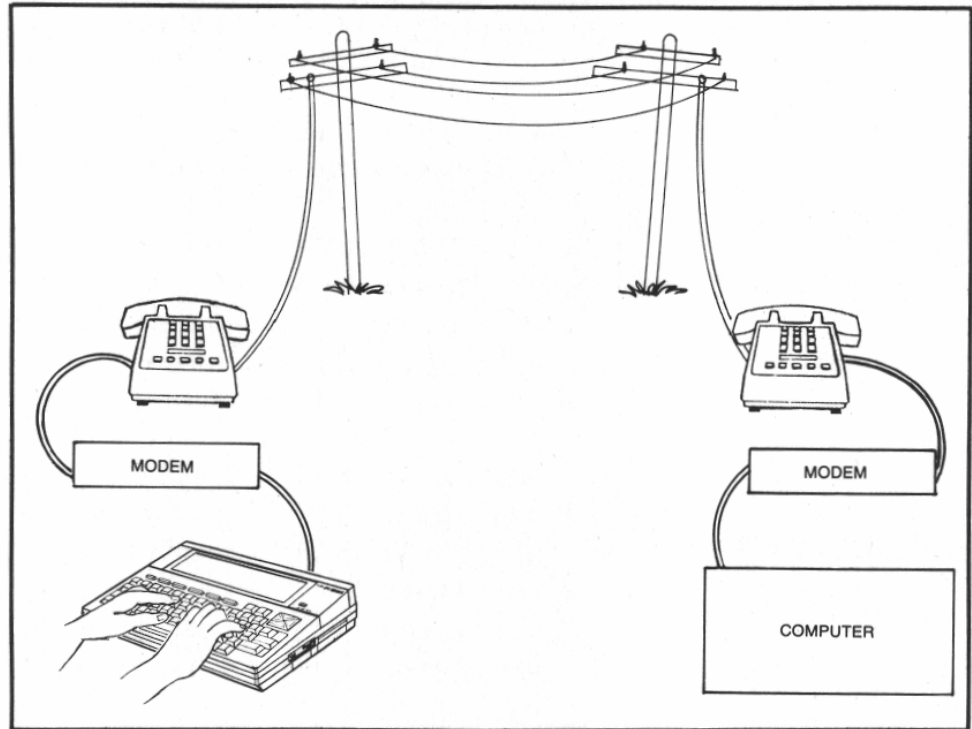


Fig. 9-1 Computer to Computer Telecommunications

puters while newspaper people pour their stories into terminals linked across the nation. Numerous information services, discussed more fully in chapter 11, serve the business and home computers 24 hours a day. Telecommunications between computers has become a taken-for-granted function that has enhanced the usefulness of these machines a hundred-fold.

## TELCOM

TELCOM is one of the three resident programs contained in the 32K ROM (Read Only Memory) of the NEC PC-8201A. It is a routine that makes possible the link-up of the 8201A and other computers in observance of the RS-232C protocol. With the help of TELCOM, you can transfer programs or data files from the 8201A to other machines (*uploading*) or bring information into the machine from other sources (*downloading*). Every significant parameter of the RS-232C protocol can be set by the user. These include:

1. Communication Speed (BAUD rate)—from 75 to 19200 bits per second

2. Parity—odd, even, none or ignored
3. Word Length—6, 7 or 8 bits per word
4. Stop Bits—either 1 or 2
5. Control according to “X” parameter—affected or non-affected
6. Control according to shift IN/OUT sequence—affected or non-affected

It is not necessary to understand fully the technical aspects of each of these parameters. What is important is to make certain that both the sending and receiving terminals observe the same status. Reliable transmission can only take place if both parties are communicating at the same speed and with the same word structure, regardless of what it may be. There is not just one standard arrangement due to the variety of transmission lines and equipment. Ordinary telephone circuits cannot typically transmit data accurately at rates faster than 1200 baud. This slow rate is intolerable for some business applications, and other data links (microwave, land-lines, etc.) are employed for both speed-up and security reasons. Word length and parity also play a part in data reliability and are varied to suit the needs of the communicators.

While a modem is needed to communicate with a remote computer, a direct connection can be made between machines that are within a few hundred feet of each other. This also permits faster, more reliable transmission. TELCOM is versatile enough to handle either arrangement.

---

## **Working with TELCOM**

To use the TELCOM program, a connection must be made to the 25 pin female connector on the back of the 8201A that is labeled RS-232C. If communications will be directed to a nearby computer, a cable such as the one illustrated in Figure 3-6 (chapter 3) can do the job. Much depends on the circuits in the other machine as to whether a problem will be encountered. If transmission is going to a remote computer, then a modem is needed so that the telephone lines can be used as a data link. Numerous modems are offered that will perform satisfactorily. The more expensive ones offer both 300 and 1200 baud capability as well as other useful features, such as *auto answer/auto dial*. One of the least expensive modems on the market that works reliably with the NEC PC-8201A is the Authentic 300 MD offered by NEC. It is, in reality, the same unit as the VolksModem produced by Anchor Automation Inc. (see Figure 3-5, chapter 3). It is lightweight, weighing less than a pound, and battery operated, making it an ideal companion to the 8201A. It is simple to



operate—only two controls. Full instructions for its use come with the device, but it need only be connected to the 8201A and your telephone, using the accompanying cables, in order to perform satisfactorily.

### Starting TELCOM

Entry into the TELCOM program is accomplished by moving the Main Menu cursor over the word TELCOM and pressing the <enter> key. The display will then appear, as shown in Figure 9-2.

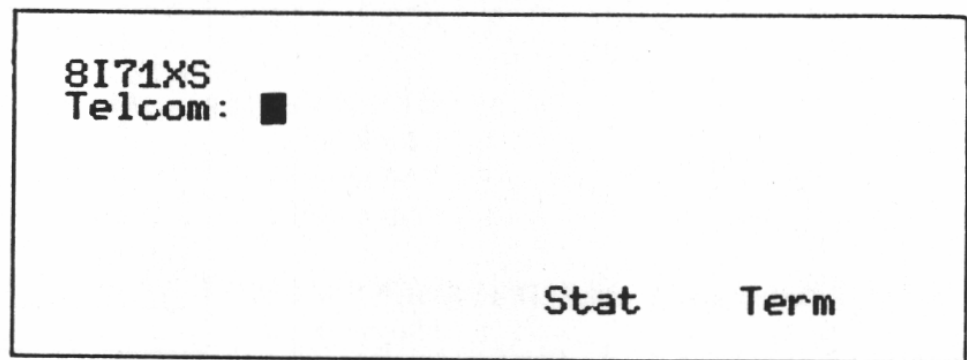


Fig. 9-2 Telecom Display

The current data transmission format status appears in the upper left hand corner of the screen. If it has never been altered by you, then the characters 8I71XS will be indicated. These figures refer to the communication protocol that TELCOM is set to use. It can be changed easily, as required, by pressing the f-4 function key. The parameters represented by each of the six characters is as follows:

#### A. Communication speed (baud rate)

1. 75 bps (bits per second)
2. 110 bps
3. 300 bps (most frequently used)
4. 600 bps
5. 1200 bps
6. 2400 bps
7. 4800 bps
8. 9600 bps
9. 19200 bps

Each of these speeds is roughly twice that of the previous one. In actual practice, number 3 (300 Baud) is most commonly used for phone modem operation. More expensive modems (and high quality phone lines) can handle 1200 baud. Baud rates of 2400, 4800 and

9600 are used for hard-wire communications between adjacent computers or from a computer to a printer. Baud speeds of 75 and 110 date back to early teletype transmission and are not commonly in use today. The fastest baud rate, 19200, is not reliable and can introduce data errors if used under any but the most stringent conditions.

#### B. Parity

- N No parity
- E Even parity
- O Odd parity
- I Parity ignored

#### C. Word Length

- 6 6 bit length
- 7 7 bit length
- 8 8 bit length

#### D. Stop Bit

- 1 1 Stop bit
- 2 2 Stop bits

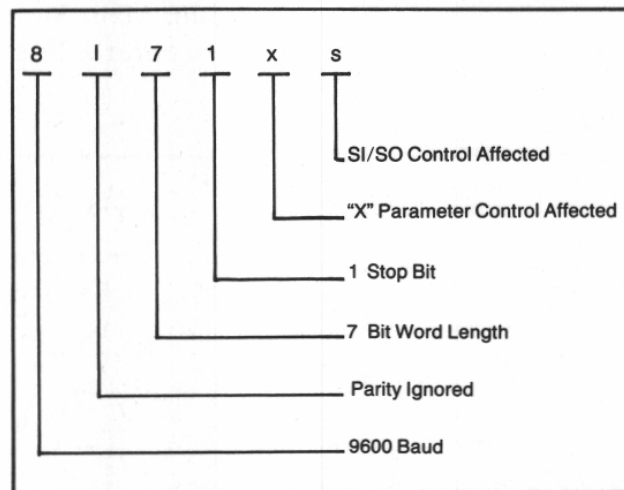


Fig. 9-3 Telecom Status Representation

#### E. Control according to "X" parameter

- X Affects control
- N Does not affect control

#### F. Control according to Shift IN/OUT sequence

- S Affects control
- N Does not affect control

The status of "8I71XS", therefore, represents a data transmission speed of 9600 bits per second with the parity bit ignored and a 7 bit word length with one stop bit. Control is affected by both the "X" parameter and the SI/SO sequence. If you are using TELCOM in conjunction with any simple, low-cost modem to access the various information services such as DOW JONES, then a more appropriate setting would be 300 Baud, parity ignored, 7 bit word with 1 stop bit. Neither the "X" or SI/SO are needed. This setting can be made by pressing the f-4 key, which places the word "Stat" on the display, and then typing 3I71NN <enter>. Once this is done, it need not be entered again unless you wish to change the status to suit some other modem or communication protocol.

Two other function keys are operative at this level. The f-10 key (SHIFT/f-5) will terminate the TELCOM program and return you to the Main Menu. The f-5 key will switch you into the "terminal" mode and the display will appear as in Figure 9-4. You are now

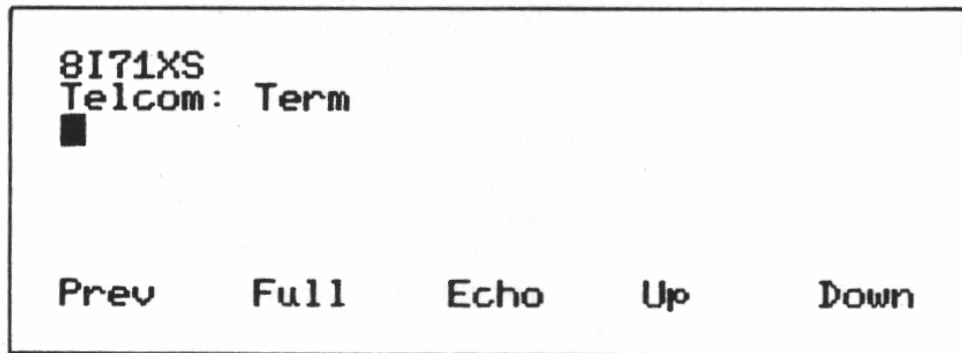


Fig. 9-4 Term Display

prepared for two-way transmission. When in this mode, there are six new functions that may be utilized by pressing the appropriate f-key.

**f-1 Prev.** If transmissions are being received and data has scrolled off the top of the display, the previous eight lines may be reviewed by pressing the f-1 key. Pressing this key again will return the display to its current mode.

**f-2 Half/Full.** Toggling the f-2 key will alternately place you in either half-duplex or full-duplex operation. Half duplex means that every key you strike will show up on the display and be sent out to the other computer as well. No return is expected from the other unit and sending and receiving cannot be executed simultaneously. Full-duplex operation infers that your keystrokes are transmitted, and the other unit verifies and echoes them back to you. What then appears on your screen is, in reality, the return from the other computer. Sending and receiving are carried on at the same time. In general, you would want to remain in the full-duplex mode when communicating with any of the information services and switch to half duplex only when directly linked to another personal computer.

**f-3 Echo.** If a printer is attached to the 8201A's parallel printer port, it can be utilized while in communication with another computer. Alternately pressing the f-3 key will cause whatever is being received to be "echoed" to your printer or not. This can be invoked at any time. It provides a means for capturing on paper the important portions of your data transmissions. The word Echo will appear on the last line of the display if you have placed your printer "on-line".

**f-4 Up.** If you wish to transmit a DO file from your NEC PC-8201A to another computer, it can be accomplished by first

making contact with the other unit and then switching into the "upload" mode. Only a DO file can be transmitted by you since both BA (BASIC) and CO (machine language) files contain non-alphanumeric symbols that are not recognizable under the RS-232C format. Pressing the f-4 key brings a request for the name of the file you wish to transmit (Figure 9-5). If the file you name is non-existent, then the upload will be cancelled. When a proper .DO file name has been entered, transmission begins immediately after the <enter> key is pressed. The word "Up" will be inverted into clear letters on a black background while the upload is being executed. Keyboard entry cannot be made until the upload transmission is completed. Pressing the SHIFT key will momentarily pause the transmission, and pressing the STOP key will cancel it.

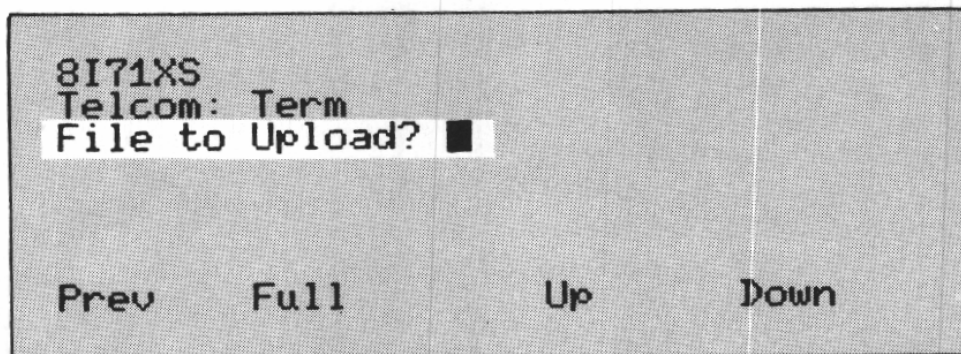


Fig. 9-5 Term's Upload Request

**f-5 Down.** If you have established contact with another computer, you can store the incoming data into a .DO file by pressing the f-5 function key. As Figure 9-6 illustrates, you will be asked for a file name to assign to the information about to be received. A .DO extension will be added to whatever name you select. An inverted image of the word "Down" will appear at the bottom of the display, indicating that the download process is underway. Pressing the f-5 key again will terminate this operation and place you back in the normal TERM mode. All data received will be found in the newly created text file, provided that sufficient memory was available to contain it all. A "beep" would have notified you that memory space was inadequate.

**f-10 Bye.** Pressing the f-10 key (SHIFT/f-5) will terminate the TERM mode and return you to the TELCOM mode. To get back to the Main Menu from TELCOM, you would need to press the f-10 key again. It is always appropriate to first "sign-off" your communications with the other computer properly before invoking the Bye sub-command.



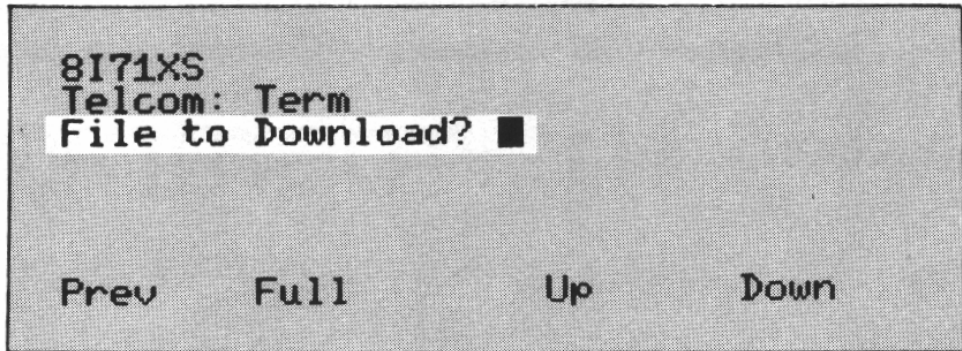


Fig. 9-6 Term's Download Request

## Summary

In Chapter 11, we present an overview of services that are available for use with the NEC PC-8201A. In discussing one such "electronic newswire", we demonstrate in a step-by-step manner how TELCOM is used to access and communicate information over your phone line. This chapter has prepared you for that activity by exploring the basic technique of the TELCOM program and detailing the various functions that are available.

---

# CHAPTER 10 Programs to Guide You

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## THE PERSONAL APPLICATION KIT

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The NEC PC-8201A contains three powerful programs in ROM (Read Only Memory) that are always available to you whenever the machine is turned on. In addition, a pre-recorded cassette is supplied that has 25 programs stored on it (Figure 10-1). These can be transferred to the 8201A at any time and run by you as the need arises. The process for moving these individual cassette programs into the 8201A is outlined in detail in chapter 4. NEC supplies a separate reference manual entitled *Personal Application Kit Guide* which describes each of these programs. In this chapter we will briefly critique them and comment on their purpose and implementation.



Fig. 10-1 The Personal Application Kit

(Photo courtesy of Tom McAfee Studios, San Francisco)

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## CALC

The first of these software items is entitled *CALC*, written for the NEC PC-8201A by Micro Video Corp. of Ann Arbor, Michigan. The program does nothing more than convert the 8201A into a four-function calculator with a single memory register. Long strings of calculations (up to 100) can be performed, and a print-out of the work can be commanded at any time. The program is handy and accurate but has dubious value as a replacement for any convenient pocket calculator. It occupies nearly 2400 bytes of memory space which makes it an unlikely candidate to live permanently in your machine. You are the best judge of the value of having this simple utility resident in your 8201A.

---

---

## TXFORM

TXFORM is a trivial program that is designed to be a formatter of the text created by you as .DO files. It does not accomplish much more than the List function available to you from the Main Menu. Some parameters for setting page width and margins can be changed, but not conveniently. It is necessary to edit the program and resave it just to accomplish that much. The clever program, contributed by Mr. David Ahl of *Creative Computing* magazine, that appears in this book's chapter 8 is far more versatile and is worth the effort to "key" in to your machine as a suitable text formatter. Then too, numerous text printing programs are available from other sources, some of which are described in chapter 11. Though TXFORM is included on NEC's cassette at no additional cost, its serious limitations make it all but unusable for the purpose intended.

---

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## INVEST

This program is designed to help you monitor your personal investment portfolio. It was written for the NEC PC-8201A by Micro Video Corp. and occupies 3400 bytes of memory (25% of all available space). Its size increases as you enter more listings and, unless the program is "saved" out onto the cassette recorder, they must be re-entered each time you load this software in. The program makes efficient use of the display and performs quickly and accurately. It is awkward in its demand for the user to edit the program in order to enter new investments. A more sophisticated approach would have

been to make use of the cassette as a data storage file. Overall, the program is too simplistic to be considered seriously for investment management purposes.

---

## **FCAST**

The next BASIC program on the supplied tape is a clever Linear Forecasting package entitled FCAST. It is also a product of Micro Video Corp. and, as with their other products, makes full use of the computational capabilities of the resident Microsoft BASIC. The program presents a menu that first requests data values to be entered and then proceeds to produce a regression forecast. It next displays this information in both tabular and bar chart form. Its interesting creation of histograms could serve as a model for programs that you might wish to create. The routine that accomplishes the graphic presentation begins at line 670 in the program. While other programs offered for sale go far beyond the simple statistical analysis offered by FCAST, it performs well in its limited way and is worth exploring.

---

## **LOAN**

This Loan Evaluator program is useful, though it only offers an approximation of the information you might desire. Its opening menu asks you to select the missing parameter to a loan calculation. If you know the loan amount, interest rate and term of the loan, for example, the program will go on to calculate the monthly payments. It then permits you to alter any one of the three supplied parameters and proceeds to recalculate the payment. After the loan is correctly defined, it can be summarized and a complete amortization schedule can either be displayed or directed to your printer. While you are cautioned not to take the results too literally, because of add-on bank fees and late charges, the package provides a simple and quick means for estimating the cost and schedule of a simple consumer loan.

---

## **SCHDL**

SCHDL is a BASIC program that serves as a simple but efficient Schedule Keeper. Written for NEC by System Soft, it works in conjunction with a TEXT file which you must create under the file



name of SCHDL.DO. You can enter as many schedule records as you wish in a free style limited only to 78 characters per entry. It is also possible to enter a time at which you wish an alarm to sound. Running SCHDL then presents a menu that permits you to enter a key word or date. If, for example, you had created a record that read "05/01 Dinner with Fred", either the date of 05/01, Fred's name or the word "Dinner" would produce this record on the screen. In this manner, you can retrieve and print out, if desired, those records that match your search parameter. The alarm function can be toggled on or off, or left to be activated when the set time arrives. To round off the functions of this handy piece of software, you can ask for a display of the current month's calender or any previous or future one. This software package is worth examining and may prove to be useful in spite of the 5000 plus bytes of memory it absorbs from your 8201A.

## CHRDEF

The NEC PC-8201A has a GRPH key that allows the user to produce three simple graphic figures on the screen whenever this key is pressed in combination with either the Z, X or C keys (see chapter 1). One of these symbols can be displayed whenever the machine is in the BASIC mode by either pressing the first combination or by entering the statement, PRINT CHR\$(128) <enter>. Substituting 129 or 130 brings the other symbols to the screen. The CHRDEF (Character definer) program permits you to design any additional graphic characters you wish and then relegates them to a machine language file for implementation in your programs.

When the program is started, you are greeted by a screen similar to that illustrated in Figure 10-2. The few instructions you need are itemized on the right and a blank "sketch-pad" is provided

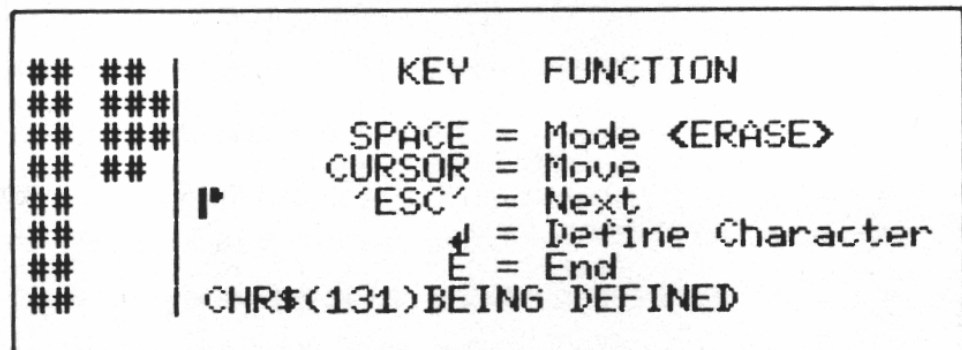


Fig. 10-2 Creating a symbol with "CHRDEF"

on the left-hand side of the display. It contains eight rows of six columns each. By moving the cursor around in this workspace (using the cursor cluster keys) and alternately pressing the space bar to "write" or "erase", you can create any symbol you wish within these limits. As you work in this manner, a true image of the figure you are creating appears on the fifth line of the display next to the sketch pad border. You can backup and erase, or restart the design as necessary. Pressing the <enter> key saves the symbol you just invented in memory and clears the screen for the next one. As many as 61 characters can be created at one sitting and then saved in a file whose name you designate. Numerous files containing such sets can be designed and stored in memory (or on tape) and thus, an unlimited number of symbols is available. The GRPH key in combination with other keys (starting with the letter V and moving across and up the keyboard) will then produce whichever characters are currently available.

This powerful program significantly extends the graphics capability of the 8201A and is worth mastering if you have need for special images within your programs. The game programs, also contained on the *Personal Application Kit* tape, make extensive use of this technique.

#### NOTE

NEC has issued an update to the CHRDEF.BA program that expands the generated character set out to 255 rather than the previous 159. To determine whether your copy has this correction, enter BASIC and load in CHRDEF.BA. List line 12. If no information appears on the screen then the following changes should be entered:

Add statements 11 and 12:

```
11  REM Updated for the PC-8201A
12  REM NEC Home Electronics, 11/4/1983
```

Change statements 110,120,150,160,260,600,610,650 and 690:

```
110  REM Using Address F091-F37F
120  CLEAR 256,61584:DIM M(5,7):DEFINTB-Z
150  POKE 65215,145:POKE 65216,240
```

(continued)

```

160 H=131:C=0:AD=61585
260 X=0:Y=0:MX=0:MY=0:H=H+1
600 CLS:PRINT "DEFINED CHARACTER(131-255)"
610 FOR I=131 TO 255
650 PRINT CHR$(I);" ";:NEXT
690 BSAVE N$,61585,750

```

Finally, delete line 620,630 and 640. Then resave the program on tape for future use.

## BACKUP

The program entitled BACKUP.BA is a simple BASIC program that acts as a loader for the next program on the *Personal Application Kit* tape. It is labeled as BACKUP.CO and, as its suffix implies, is a machine language routine. Running BACKUP.BA performs the task of BLOADing the true program and then BSAVEing it into a high memory location. The purpose of the program is to enable the user to copy all the files from one designated bank of memory (the NEC PC-8201A provides for 3) to another. This is especially valuable if you are equipped with the removable plug-in 32K RAM cartridge (NEC part/PC-8206A).

### CAUTION:

The program starts by erasing all existing files in the destination bank to make room for the new ones. The alternative to using this utility routine is to first save each file that you wish to provide a backup for onto cassette tape. That action is followed by switching banks (see chapter 1) and re-loading them one by one into the 8201A. The convenience of using the BACKUP software supplied by NEC is evident.

## XFILES

A companion routine to BACKUP appears next on the *Personal Application Kit* tape supplied with the NEC PC-8201A. In much the same fashion, loading and running the XFILES.BA program is merely a first step to inputting the machine language routine of the same file name. This program's function is to permit the user to transfer selected files from one bank to another. The provision also

exists for copying a file onto the same bank (but not for .DO files). Since this routine is non-destructive of the receiving banks existing files, it is valuable as a means for "backing-up" your most important programs onto other memory locations.

---

## **BA**

The BANK ACCESSOR (BA) utility completes the trio of routines that handle file transfer between banks of memory in the 8201A. Just as with BACKUP and XFILES, this program is preceeded by a BASIC loader that retrieves and executes the machine language routine. When properly installed, you then have the ability to read and write files on other banks while in BASIC. Without this software resident in memory, BASIC would not permit you to address other than the 32K of RAM that constitutes the currently selected bank. BA.CO overcomes this limitation and extends the available capacity by a considerable margin.

---

## **TERM**

If you are using the TELCOM resident software to access a number of different computers, each of which requires a unique STATUS mode, then this utility (TERMinal Mode Selector) will prove useful. It permits you to create and maintain a DO file of up to 20 different communication statuses, each labeled by any identifier you wish. After setting up this library of STATs, you can run this program prior to each communication link-up, select the matching mode, and then enter TELCOM with that status mode in effect. The alternative is to enter TELCOM, invoke STAT and change the mode manually to match the communication you are going to attempt. TERM relieves you of this operation, as well as serving as a permanent directory of correct status parameters. The 4000 characters of memory that the program preempts (plus the DO file space) is the price you pay for this convenience.

---

## **JAN-NWH-COD- BCR-DEMO**

One of the important options that the NEC PC-8201A offers is the ability to work with an inexpensive bar code reader. In chapter 6, the reader was described and some uses discussed. The *Personal Application Kit* contains five programs that enable a bar code



reader to function and be demonstrated adequately. The first three programs (JAN-NWH-COD) are all machine language routines, each of which is meant to be used with a different style of code. In the world of bar codes, there are numerous standards that have evolved for varying purposes. The 8201A software routines address themselves to three of these, the JAN or EAN code, the NM7Hex code and the 3 of 9 or CODE-39. In the United States, the JAN code is known as the UPC (Universal Product Code) and is the garden variety supermarket code found on canned food product labels. In addition to the examples given in the NEC *“Personal Application Kit Guide”*, therefore, excellent test samples of JAN/UPC code can be discovered on your own pantry shelves.

The procedure for demonstrating the bar code reading function is as follows:

1. Enter BASIC and type in: CLEAR 256,60111 <enter>
2. With Side B of the Personal Application Kit in the recorder, type in: BLOAD “CAS:JAN” <enter>
3. Type in: BSAVE “JAN”,60112,2212 <enter>
4. Type in: CLOAD “DEMO” <enter> then RUN <enter>

The display will state: BAR CODE READ: and repeated moves of your bar code reading device over various samples will produce a line of numbers on the screen and a confirming high pitched “beep”. If the reading was poor, only a low pitched tone will be heard and no screen indication. The program can be terminated by pressing SHIFT/STOP.

The *Personal Application Kit Guide* offers examples of the other two codes as well as sample programs that permit reading in BASIC lines of code and “merging” them with your own programs. The 33 page coverage of this one topic, along with the five related cassette programs, covers this esoteric, but nonetheless useful, subject adequately.

## MUSIC

The NEC PC-8201A has a limited capability to produce sound by means of a piezo-electric transducer contained in the machine. It can create single tones spanning six octaves. The frequency and duration of these tones are programmable. The MUSIC program (and the companion DO files, MDATA1 and MDATA2) serve as a demonstration of this feature. When run, the program will either play previously created music or prompt you to compose new tunes. The two data files MDATA1 and MDATA2 offer approxima-

tions of the "Theme from the Bridge on the River Kwai" and a Bach contata. No one would mistake the music produced for the Los Angeles Philharmonic, but the ability to spice up your BASIC programs with sound effects is appealing. You are aided in your composition by a set of on-screen instructions and the clever use of a simulated piano keyboard using the lower two rows of the 8201A's keys. This software routine performs well as a tutorial for tone generation and is novel in its performance.

---

## **TANK - SNAKE**

Finishing off the free software supplied by NEC with the 8201A are two animated games programs entitled TANK and SNAKE. Both are clever examples of the character-definition capabilities of the machine, as well as its sound effects feature. Considering the one-color, limited size display of the NEC PC-8201A, the authors of these two arcade-style divertissements have done a good job. Other than as an example of the versatility of the machine, neither program has any serious value for the busy, on-the-go user of the 8201A—unless you believe that "all work and no play.....".

---

## **Summary**

This chapter has explored the full spectrum of software included with the NEC PC-8201A on the *Personal Application Kit* cassette. The 25 programs load reliably and represent a potpourri of useful utilities, trivial applications and frivolous games. All of them serve as beneficial examples of BASIC programming on the 8201A. The user would do well to familiarize him or herself with this material.

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# *CHAPTER* 11 Add-On Products & Services

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## SOFTWARE

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In typical fashion, numerous software publishers have created applications programs which they market to NEC PC-8201A owners. These programs range from sophisticated spreadsheet generators to word processors and games. All of them are packaged on cassettes and are accompanied by documentation with instructions for program operation. It is beyond the scope of this book to provide a detailed critique of the dozens of programs presently available. What follows, however, is a categorical listing of advertised software and the various producers who offer it. A mention here is not to be construed as an endorsement of the material. Whenever possible, you should attempt to get a demonstration copy or locate a review of the program that interests you before investing in it.

### **Word Processors and Print Formatters**

THE TRAVELING WRITER  
Traveling Software, Inc.  
11050 Fifth Avenue Northeast  
Seattle, WA 98125  
(206) 367-8090

TEXT POWER  
The Covington Group  
310 Riverside Drive, Suite 916  
NY, NY 10025  
(212) 678-0064

AUTOPEN  
Chattanooga Systems Associates  
P. O. Box 22261  
Chattanooga, TN 37422  
(615) 892-2339

### **Electronic Spreadsheets**

AMERICAN CALC  
American Micro Products, Inc.  
705 North Bowser  
Richardson, TX 75081  
(214) 238-1815

PORTACALC  
Skyline Marketing Corp.  
4510 W. Irving Park Rd.  
Chicago, IL 60641  
(312) 286-0762

### **Tax Planning and Preparation**

PORTATAX  
Skyline Marketing Corp.  
4510 W. Irving Park Rd.  
Chicago, IL 60641  
(312) 286-0762

THE TRAVELING TAX MANAGER  
Traveling Software, Inc.  
11050 Fifth Avenue Northeast  
Seattle, WA 98125  
(206) 367-8090

TAX PREP  
DatAccount  
516 S.E. Morrison,  
Suite 820 - Portland, OR 97214  
(503) 232-0490

### **Statistical Analysis**

PORTASTAT  
Skyline Marketing Corp.  
4510 W. Irving Park Rd.  
Chicago, IL 60641  
(312) 286-0762



### **Graphic Plotting**

AUTO PLOT  
Menlo Systems  
3790 El Camino Real, Suite 221  
Palo Alto, CA 94306  
(415) 856-0727

### **DataBase Management**

DATA +  
Portable Computer Support Group  
11035 Harry Hines Blvd., No. 207  
Dallas, TX 75229  
(214) 351-0564

DATA-DEX  
DatAccount  
516 S.E. Morrison, Suite 820  
Portland, OR 97214  
(503) 232-0490

Many more programs are certain to become available for the NEC PC-8201A in the near future. Software publishers who have created packages for Tandy's Model 100 are translating their programs to run on the 8201A as well. When ordering from any publisher, be sure to specify the 8201A as tapes created for one machine will not load onto the other.

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## **Peripherals**

Outside suppliers have also come forth with various peripheral devices that are compatible with the 8201A and enhance its performance. A cross-section of some of these offerings is listed below.

### **High Speed Tape Storage System**

PMD-100  
Holmes Engineering, Inc.  
5175 Green Pine Drive  
Salt Lake City, UT 84123  
(801) 261-5652

### **Data Acquisition System**

PL-100  
Elexor Associates  
P. O. Box 246  
Morris Plains, NJ 07950-0246  
(201) 299-1615

### **Auxilliary Power Supply**

PRAIRIE POWER  
Bluestem Productions  
P. O. Box 334  
Wayzata, MN 55391  
(612) 471-7795

### **Telephone Modem**

AJ 1212-ST  
Anderson Jacobson  
521 Charcot Ave.  
San Jose, CA 95131  
(408) 286-7960

SMARTMODEM  
Hayes Microcomputer Products  
5923 Peachtree Industrial Blvd.  
Norcross, GA 30092  
(404) 441-1617

### **Bar Code Reader**

Model 100 BCR  
Tandy Corporation  
300 One Tandy Center  
Fort Worth, TX 76102  
(817) 390-2842

Bi-Tech  
BT Enterprises  
10 Carlough Road  
Bohemia, NY 11716-2996  
(516) 567-8155

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## **Accessories**

### **Add-on Memory Modules**

8K RAM Module  
Purple Computing  
4807 Calle Alto  
Camarillo, CA 93010  
(805) 987-4788

8K RAM Module  
Spectrum Projects  
93-15 86th. Drive  
Woodhaven, NY 11421  
(212) 441-2807

### **Desk Top Stand**

POCO STAND  
Diskus Products  
6003 Bandini Blvd.  
Los Angeles, CA 90040  
(213) 726-3088

### **Carrying Case**

American Tourister  
91 Main Street  
Warren, RI 02885  
(800) 341-6311

CHIP-TOTE  
Kangaroo Video Products Inc.  
9190 Manor Drive  
La Mesa, CA 92041  
(619) 698-0230

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## **Publications**

More than 150 magazines devoted to microcomputers are presently being published in the United States and Europe. A few of these publications are dedicated solely to the Briefcase Computer and feature articles and information which relates exclusively to the smaller machines. Though a couple of them address themselves almost entirely to the Tandy Model 100, these magazines can also be useful to the NEC PC-8201A owner. A list of a few leading publications is included here.

Portable Computer  
500 Howard Street  
San Francisco, CA 94105  
(415) 397-1881

Portable 100  
67 Elm Street  
Camden, ME 04843  
(207) 236-4365

PCM  
The Portable Computing Magazine  
9529 U. S. Highway 42, Box 209  
Prospect, KY 40059  
(502) 228-4492

Creative Computing  
39 East Hanover Ave.  
Morris Plains, NJ 07950  
(201) 540-0445

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## **Information Services**

Within the last few years, a number of computerized subscription news services have come into existence. Using a modem in conjunction with your NEC PC-8201A (see chapter 9) can put you in communication with any of them. They all charge for their services and usually require a sign-up fee that earns you a unique password used for billing purposes. Each of them has a special orientation; from



financial news and encyclopedic databases to games and informal "tele-chatting". An overview of the four largest of these services is offered here.

**DOW JONES NEWS/RETRIEVAL**

P. O. Box 300

Princeton, NJ 08540

(800) 257-5114

Rates: Standard Usage — One-Time fee \$75

Prime Time - \$.60 to \$1.20 per min. (depending on service)

Non-Prime Time - \$.20 to \$.90 per min.

**Services Offered:**

Business and Economic News

Stock Quotations

Financial and Investment Services

General News and Information Services

Mail Service and Customer Newsletter

**THE SOURCE**

1616 Anderson Road

McLean, VA 22102

(703) 734-7500

Rates: Standard Usage — One-Time fee \$100

Prime Time - \$20.75 per hour

Non-Prime Time - \$7.75 per hour

**Services Offered:**

Communications (SourceMail Chat Mailgram)

News and Sports

Business and Finance

Consumer Services

Entertainment/Games

Travel Services

Publishing

**NEWSNET**

945 Haverford Road

Bryn Mawr, PA 19010

(800) 345-1301

Rates: Standard Usage — No subscription fee

Prime Time - \$24.00 to \$48.00 per hour (SCAN or READ)

Non-Prime Time - \$18.00 to \$40.00 per hour

**Services Offered:**

International Newswires

NewsLetter Search and Excerpt

NewsFlash

Electronic Mail

**COMPUSERVE**

PO.Box 20212

5000 Arlington Centre Blvd.

Columbus, OH 43220

(800) 848-8199

**Rates:** Standard Usage / \$30 subscription fee

Prime Time - \$6.00 per hour

Non-Prime Time - \$12.50 per hour

**Services Offered:**

Information Utilities

Games and Entertainment

Electronic Mail

The fees listed above are approximate and change as a function of the services requested. In addition, they all offer special "get-acquainted" rates from time to time. Free literature, describing the current services and rates, is available from any of the above.

There are also over 2000 free *Computer Bulletin Boards* in the country. These BBS's (Bulletin Board Service) have limited informational services and usually feature a means for users to hang electronic notes on an imaginary bulletin board for each other to read. The cost is limited to your phone-connect charges only. A directory of over 1300 of the currently active ones is available by sending \$2 to:

Thomas Wnorowski

3352 Chelsea Circle

Ann Arbor, MI 48104

His interesting little publication can furnish you with local numbers that will allow you to practice your "log-on" telecommunications procedures.

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## **A Compu-Serve Demonstration**

A free demonstration of how the subscriber information services work is possible. Because free time is not given during prime hours, you can stage this demo only between the hours of 6 P.M. and 5 A.M. (your local time) weekdays or most any hour on the weekend. You will need a modem, modem cable and, of course, the NEC PC-8201A. Following the instructions furnished with the modem, connect the computer to it and follow these steps:

1. Call COMPU-SERVE at 1-800-848-8990 and ask for the Free Demo access phone number in your city (in the Los Angeles area it is 739-8906).

2. Enter TELCOM and press f-4.
3. Type in: 3I71NN <enter> .
4. Press f-5 (you are now in the TERM mode).
5. Dial the access number and when you hear a high-pitched tone, switch your modem from TALK to DATA.
6. Press the <enter> key twice.
7. In response to the query, Host Name:, type in:  
CPS <enter> .
8. In response to User ID:, type in: 77770,101
9. In response to Password:, type in: FREE-DEMO. Be sure to use uppercase letters for all entries. You will not see the Password appear on the screen as you enter it. Don't forget the hyphen between the words FREE and DEMO.

You will now be able to explore the various menus and services that Compu-Serve has to offer. You will not be able to actually take advantage of the services, but you will get a good idea of what is available. The demo is free and your cost will only be the price of the local phone call.

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## Summary

This chapter introduced you to the world of NEC PC-8201A compatible software, hardware and services. From memory chips to accounting packages, it has attempted to offer a taste of the available programs, services and accessories provided by manufacturers other than NEC. This is but a foundation of such goods and services. Most surely, in the months and years to come, a proliferation of add-ons will appear on the market as the usefulness and versatility of the NEC PC-8201A becomes publicized.





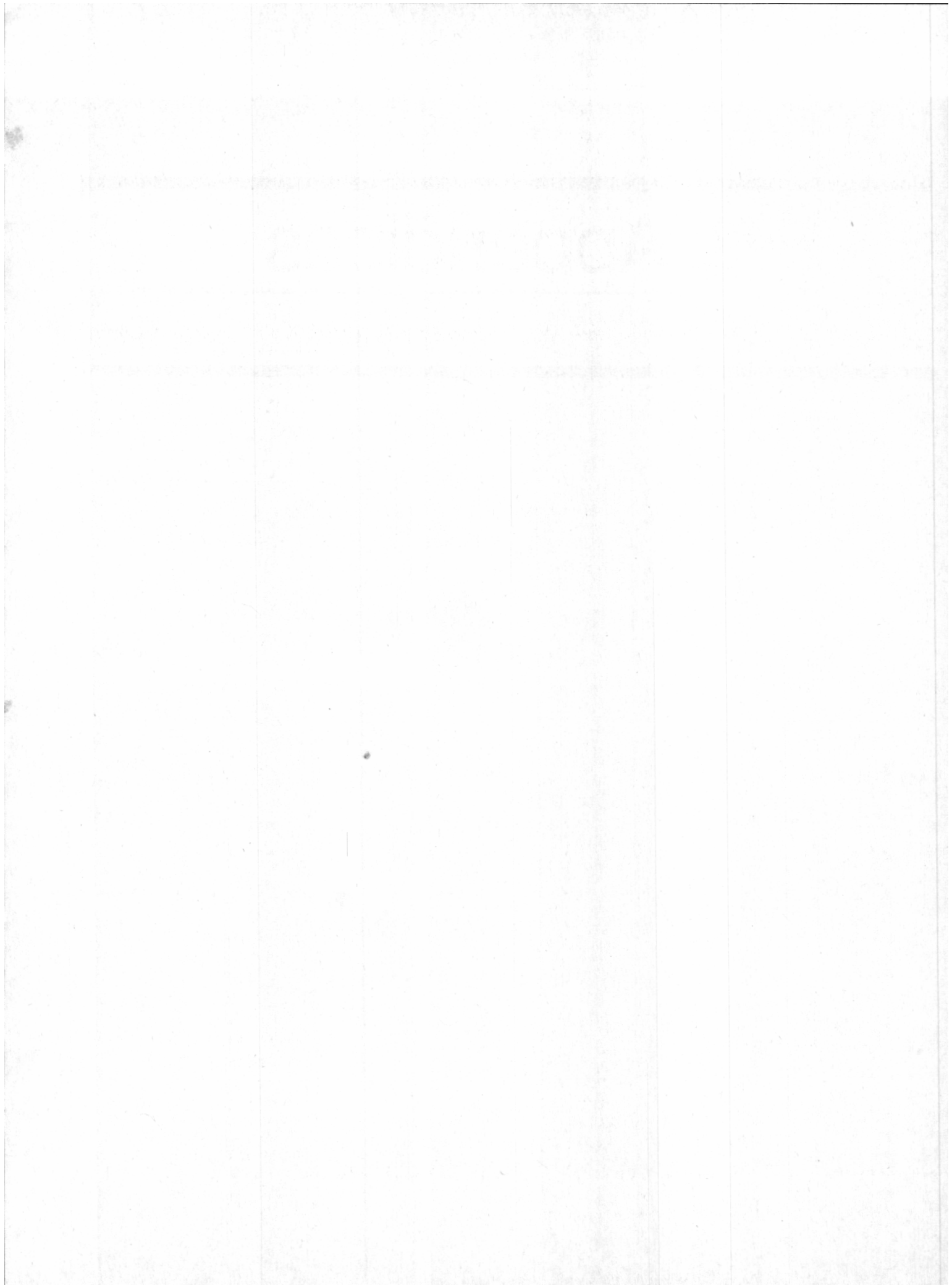
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*PART* 3 Appendices

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**APPENDIX****A****CONTROL KEY**

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**INTERNAL  
CHARACTER  
CODE****OPERATION**

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**FUNCTION**

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0	—	none
1	—	none
2	—	none
3	CTRL/C	STOP
4	—	none
5	—	none
6	CTRL/I	TAB
7	CTRL/G	BEEP
8	CTRL/H	BackSpace
9	—	none
10	—	none
11	CTRL/K	HOME
12	CTRL/L	ClearScreen
13	CTRL/M	<enter>
14	CTRL/N	Shift OUT
15	CTRL/O	Shift IN
16	—	none
17	CTRL/Q	Req.Interrupt
18	—	none
19	CTRL/S	Reopen Trans.
20	—	none
21	—	none
22	—	none
23	—	none
24	—	none
25	—	none
26	—	none
27	ESC	Begin Escape
28	→	Cursor Right
29	←	Cursor Left
30	↑	Cursor Up
31	↓	Cursor Down

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# *APPENDIX* **B** ESCAPE SEQUENCES

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INTERNAL CHARACTER CODE	OPERATION	FUNCTION
65	ESC/A	Cursor Up
66	ESC/B	Cursor Down
67	ESC/C	Cursor Right
68	ESC/D	Cursor Left
69	ESC/E	HOME
74	ESC/J	Erase to end of display
75	ESC/K	Erase to end of line
76	ESC/L	Insert line
77	ESC/M	Delete line
80	ESC/P	Cursor ON
81	ESC/Q	Cursor OFF
84	ESC/T	Function Keys ON
85	ESC/U	Function Keys OFF
86	ESC/V	Scrolling OFF
87	ESC/W	Scrolling ON
89	ESC/Y	Re-locate Cursor
106	ESC/j	Clear Screen
108	ESC/l	Erase entire line
112	ESC/p	Inverse Display
113	ESC/q	Normal Display



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# APPENDIX C BASIC COMMANDS, FUNCTIONS, AND STATEMENTS

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## COMMAND

## PROPER FORMAT

ABS	ABS(<numeric expression>)
AND	<operand1> AND <operand 2>
ASC	ASC(<string>)
ATN	ATN(<numeric expression> )
BEEP	BEEP
BLOAD	BLOAD " { <external device name> : } <file name> "
BLOAD?	BLOAD? " { <external device name> : } <file name> "
BSAVE	BSAVE " { <external device name> : } <file name> ", <start address> , <length> { , <execute start location> }
CDBL	CDBL( <numeric expression> )
CHR\$	CHR\$( <numeric expression> )
CINT	CINT( <numeric expression> )
CLEAR	CLEAR { <string size area> } { , <maximum memory used in BASIC> }
CLOAD	CLOAD " <file name> "
CLOAD?	CLOAD? " <file name> "
CLOSE	CLOSE{ {#} <file number> } { , {#} , file number } ..
CLS	CLS
COM	COM ON - COM OFF - COM STOP
COS	COS( <numeric expression> )
CSAVE	CSAVE " <file name> "
CSNG	CSNG( <numeric expression> )
CSRLIN	CSRLIN
DATA	DATA <constant> { , <constant> } .....
DAT\$	DATE\$ = " <year> / <month> / <day> "
DEF	DEFINT - DEFSGL - DEFDBL - DEFSTR <range>
DIM	DIM <variable name> ( <max subscript value> { , <max subscript value> .... } )

COMMAND	PROPER FORMAT
EDIT	EDIT { <starting line > } { - <ending line > }
END	END
EOF	EOF( <file number > )
EQV	<operand 1 > EQV <operand 2 >
ERL	ERL
ERR	ERR
ERROR	ERROR <integer >
EXEC	EXEC <initial location >
EXP	EXP( <numeric expression > )
FILES	FILES
FIX	FIX( <numeric expression > )
FOR	FOR <variable name > = <initial value > TO <final value > {STEP <increment > }
FRE	FRE( <expression > )
GOSUB	GOSUB <line number >
GOTO	GOTO <line number >
IF/THEN/ELSE	IF <expression > THEN <clause > {ELSE <clause > }
IMP	<operand 1 > IMP <operand 2 >
INKEY\$	INKEY\$
INP	INP( <port number > )
INPUT	INPUT { " <prompt statement > "; } <variable 1 > { , <variable 2 > } ...
INPUT\$	INPUT\$( <integer expression > { , {#} <file number > } )
INPUT#	INPUT# <file number > , <variable 1 > { , <variable 2 > } ...
INSTR	INSTR( { <numeric expression > , } <char.string 1 > , <char.string2 >
INT	INT( <numeric expression > )
KEY	KEY <key number > , " <function > "
KILL	KILL " <file name.file type > "
LEFT\$	LEFT\$( <char. string > , <numeric expression > )
LEN	LEN( <character expression > )
LINE INPUT	LINE INPUT { " <prompt statement > "; } <string variable >
LINE INPUT#	LINE INPUT# <file number > , <variable 1 > { , <variable 2 > } ...
LIST/LLIST	LIST/LLIST { <starting line number > } { - <ending line number > }
LOAD	LOAD " { <external device name > : } <file name > " { , R }
LOCATE	LOCATE <horiz. coordinate > , <vert. coordinate >
LOG	LOG( <numeric expression > )
LPOS	LPOS( <numeric expression > )

## COMMAND

## PROPER FORMAT

LPRINT	LPRINT { " } { <expression> } { " }
LPRINT USING	LPRINT USING <format string>; <num. exp. list>
MAXFILES	MAXFILES = <number of files>
MENU	MENU
MERGE	MERGE " { <external device name> : } <file name> "
MID\$	MID\$ ( <character string> , <numeric expression 1> , { , <numeric expression 2> } )
MOD	<numeric expression 1> MOD <numeric expression 2>
MOTOR	MOTOR <switch>
NAME	NAME " <old file name> " AS " <new file name> "
NEW	NEW
NEXT	NEXT { <numeric variable> }
NOT	NOT <operand>
ON...GOTO	ON <numeric variable> GOTO <line number>
ON. . .GOSUB	ON <numeric variable> GOSUB <line number>
ON COM. .GOSUB	ON COM GOSUB <line number>
ON ERROR	ON ERROR GOTO <line number>
OPEN	OPEN " { <external device name> : } <file name> "
	INPUT
	FOR OUTPUT AS { # } <file number>
	APPEND
OPEN "COM"	OPEN "COM: { <CPBSXS> } "
	INPUT
	FOR OUTPUT AS { # } <file number>
OR	<operand 1> OR <operand 2>
OUT	OUT <port number> , <data>
PEEK	PEEK ( <address> )
POKE	POKE <address> , <data>
POS	POS ( <expression> )
POWER	POWER <time> { , RESUME }
	OFF
	CONT
PRESET	PRESET ( <horizontal coordinate> , <vertical coordinate> { , <function code> } )
PRINT	PRINT { " } { <expression> } { " }
PRINT USING	PRINT USING <format string>; <num. expr. list>
PSET	SET ( <horizontal coordinate> , <vertical coordinate> { , <function code> } )
READ	READ <variable list>
REM	REM <remark>
RENUM	RENUM { <new line number> } { , <old line number> } { , <increment> }
RESTORE	RESTORE { <line number> }

COMMAND	PROPER FORMAT
RESUME	RESUME {NEXT - < line number > }
RETURN	RETURN { < line number > }
RIGHT\$	RIGHT\$( < character string > , < numeric expr. > )
RND	RND( < numeric expression > )
RUN	RUN { < line number > }
	RUN "{ < device name > : } < program name > "{,R}
SAVE	SAVE " { < external dev. name > : } < file name > "{,A}
SCREEN	SCREEN 0, < switch >
SGN	SGN( < numeric expression > )
SIN	SIN( < numeric expression > )
SOUND	SOUND < tone > , < length >
SPACE\$	SPACE\$( < numeric expression > )
SQR	SQR( < numeric expression > )
STOP	STOP
STR\$	STR\$( < numeric expression > )
STRING\$	STRING\$( < numeric expr. > < character expr. > )
TAB	TAB( < numeric expression > )
TAN	TAN( < numeric expression > )
TIMES	TIMES = " < hour > : < minute > : < second > "
VAL	VAL( < numeric string > )
XOR	< operand 1 > XOR < operand 2 >



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# *APPENDIX* D TEXT CONTROL COMMANDS

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CURSOR OPERATION	CTRL OPERATION	FUNCTION
→	CTRL/D	Move 1 character to right
←	CTRL/S	Move 1 character to left
↑	CTRL/E	Move up one line
↓	CTRL/X	Move down one line
SHIFT/→	CTRL/F	Move one word to right
SHIFT/←	CTRL/A	Move one word to left
SHIFT/↑	CTRL/T	Move up one screen
SHIFT/↓	CTRL/B	Move down one screen
CTRL/→	CTRL/R	Move to right end of line
CTRL/←	CTRL/Q	Move to left end of line
CTRL/↑	CTRL/W	Move to beginning of file
CTRL/↓	CTRL/Z	Move to end of file

# APPENDIX E BASIC ERROR MESSAGES

ERROR MESSAGE	ERROR NO.	N82-BASIC MESSAGE	MEANING
?AO	53	Already Open	The same file has been opened before.
?BN	51	Bad Number	The file number is inappropriate.
?BO	23	Buffer Overflow	The input buffer has overflowed.
?BS	9	Bad Subscript	Subscript out of range.
?DD	10	Double Dimension	The same array is declared twice.
?DS	56	Direct Statement	An ASCII file does not load.
?DU	25	Device Unavailable	A designated device is not being used.
?EF	54	End of File	No more data in the file.
?FC	5	Function Call (illegal)	Commands or functions used incorrectly.
?FF	52	File not Found	The designated file name is not on record.
?FL	57	File Limit	There are too many files.
?ID	12	Illegal Direct	The specified command cannot be used in the direct mode.
?IE	50	Internal Error	An error has occurred within BASIC itself.
?IO	24	Input or Output Error	An error occurred during input/output operation.
?LS	15	Long String	A string variable exceeded 255 characters.
?MO	22	Missing Operand	A required parameter is missing.
?NF	1	NEXT without FOR	There is no FOR command to match a NEXT command.
?NM	55	Name (file) Mismatch	File name is inappropriate.
?NR	19	No RESUME	RESUME command missing in error routine.
?OD	4	Out of Data	Insufficient DATA for READ command.
?OF	58	File not Open	The file has not yet been opened.
?OM	7	Out of Memory	There is insufficient memory.
?ON	17	Not possible to go on.	Execution can't be resumed after CONT command.

ERROR MESSAGE	ERROR NO.	N82-BASIC MESSAGE	MEANING
?OS	14	Out of String Space	Reserved memory for strings inadequate.
?OV	6	OVerflow	A numerical value is too large.
?PC	59	PC-8001 Command	The command is used on the PC-8001.
?RG	3	RETURN without GOSUB	A RETURN statement is present without GOSUB.
?RW	20	RESUME without Error	RESUME encountered before error routine.
?SN	2	SyNtax Error	Erroneous grammar or spelling in statement.
?ST	16	STring formula too complex	The string formula used is too complicated.
?TM	13	Type Mismatch	The types of variables are inconsistent with one another.
?UE	21	Unprintable Error	Undesigned error has been encountered.
?UF	18	Undefined Function	An undefined user function has been read.
?UL	8	Undefined Line	A designated line is not present in the pro- gram.
?/0	11	Division by Zero	A division by zero was attempted.

# APPENDIX F CHARACTER CODES

DECIMAL VALUE	CHARACTER GENERATED	DECIMAL VALUE	CHARACTER GENERATED
0 to 31	Unique codes that are unprintable (See Appendix A) (space)	58	:
32		59	;
33	!	60	<
34	"	61	=
35	#	62	>
36	\$	63	?
37	%	64	@
38	&	65	A
39	,	66	B
40	(	67	C
41	)	68	D
42	*	69	E
43	+	70	F
44	'	71	G
45	-	72	H
46	.	73	I
47	/	74	J
48	0	75	K
49	1	76	L
50	2	77	M
51	3	78	N
52	4	79	O
53	5	80	P
54	6	81	Q
55	7	82	R
56	8	83	S
57	9	84	T
		85	U
		86	V



DECIMAL VALUE	CHARACTER GENERATED	DECIMAL VALUE	CHARACTER GENERATED
87	W	110	n
88	X	111	o
89	Y	112	p
90	Z	113	q
91	[	114	r
92	\	115	s
93	]	116	t
94	^	117	u
95	_	118	v
96	`	119	w
97	a	120	x
98	b	121	y
99	c	122	z
100	d	123	{
101	e	124	!
102	f	125	}
103	g	126	~
104	h	127	(no character)
105	i	128	◀
106	j	129	⬅
107	k	130	■
108	l		
109	m		
		131 to 255	User-defined characters (can be created by using CHRDEF pro- gram).

---

---

# *APPENDIX* **G COMMUNICATIONS PARAMETERS**

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In the TELCOM mode, STAT is used to define the desired communication parameters. They take the form:

STAT < c p b s x s > where:

C	=	Communications speed (BAUD rate)
P	=	Parity
B	=	Word Length
S	=	Stop bits
X	=	Line status control
S	=	SHIFT status control

The available values for each of these parameters is:

PARAMETER	TYPE	FOR
Communication Speed	1	75 Baud
	2	110
	3	300
	4	600
	5	1200
	6	2400
	7	4800
	8	9600
	9	19200
Parity	N	No parity
	E	Even parity
	O	Odd parity
	I	Parity bit ignored
Word Length	6	6 bit length
	7	7 bit length
	8	8 bit length

PARAMETER	TYPE	FOR
Stop Bit	1	1 stop bit
	2	2 stop bits
Line Status	X	Enable XON/XOFF (CTRL/Q)
	N	Disable XON/XOFF(CTRL/S)
Shift IN/OUT sequence	S	SHIFT IN
	N	SHIFT OUT

Note: Parity bit ignored (1) must be used with 8 bit word length (8).

---

---

# *APPENDIX* H OPTIONAL EQUIPMENT SPECIFICATIONS

---

---

PC-8201A-90                      Nickel-Cadmium Battery Cartridge

- \* One-half Ampere/Hour capacity
- \* Rechargeable by AC adapter
- \* Good for over 500 re-charges
- \* Provides about 5.5 hours of operation

PC-8299A-8                      8 pin S I/O cable

- \* Mates with SIO1 connector

PC-8299A-6                      6 pin S I/O cable

- \* Mates with SIO2 connector

PC-8281A                      Portable, Battery-Operated Data Recorder

- \* 300 Hz to 8000 Hz frequency response
- \* 0.16% (WRMS) wow and flutter
- \* Input sensitivity - 1 millivolt at 4.7K ohms
- \* Weight - 525 grams
- \* Dimensions - 186 mm X 116 mm X 32 mm
- \* AC bias recording - DC erasure
- \* Power consumption - 1 watt

PC-8295A1                      Modem Communication Cable

- \* Mates with RS232-C connector

PC-8294A                      Parallel Printer Cable

- \* Mates with 26 pin printer connector
- \* Centronics-compatible end connector



PC-8271A-01

AC Adapter

- \* Provides DC power to computer or RAM cartridge
- \* Rated at 100 milliamps. at 8.5 volts DC

PC-8206A

32K RAM Cartridge

- \* Lithium battery included as back-up power
- \* WRITER PROTECT switch included
- \* Contains 4 - 8Kbyte CMOS RAM chips
- \* Mates with 48 pin system slot connector

PC-8201-06

8K RAM Chip

- \* Mates with 28 pin memory socket
- \* Low-power CMOS circuitry

PC-8295A2

RS-232C Cable

- \* Mates with RS-232C connector

PC-8221A

Portable, Battery-Operated Thermal Printer

- \* Uni-directional dot matrix
- \* 8 needle pattern
- \* Speed - approximately 40 characters per second
- \* Alpha-numeric pattern - 5 x 7 dot matrix
- \* 96 ASCII characters available
- \* Print modes - 40 characters per line normal  
20 characters per line expanded  
320 dots per line graphics

PC-8271A-02

AC Adapter

- \* Provides DC power to Data Recorder or Thermal Printer
- \* Rated output - 5 volts DC

AUTHENTIC 300 MD

300 BAUD MODEM

- \* Battery operated
- \* Half/Full Duplex switchable
- \* Data/Talk switch provided
- \* Mates with RS-232C connector

For further information contact NEC Home Electronics  
1401 Estes Avenue  
Elk Grove Village, IL 60007-5463  
(312) 228-5900





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